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# A Quantitative Analysis of Factors Influencing the Professional Longevity of High School Science Teachers in Florida

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A QUANTITATIVE ANALYSIS OF FACTORS INFLUENCING THE

PROFESSIONAL LONGEVITY OF HIGH SCHOOL

SCIENCE TEACHERS IN FLORIDA

by

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# ABSTRACT

## A QUANTITATIVE ANALYSIS OF FACTORS INFLUENCING THE PROFESSIONAL LONGEVITY OF HIGH SCHOOL SCIENCE TEACHERS IN FLORIDA

by James Alexander Ridgley Jr.

December 2016

This dissertation is an exploratory quantitative analysis of various independent variables to determine their effect on the professional longevity (years of service) of high school science teachers in the state of Florida for the academic years 2011–2012 to 2013–2014. Data are collected from the Florida Department of Education, National Center for Education Statistics, and the National Assessment of Educational Progress databases. The following research hypotheses are examined: $H_1$ – There are statistically significant differences in Level 1 (teacher variables) that influence the professional longevity of a high school science teacher in Florida. $H_2$ – There are statistically significant differences in Level 2 (school variables) that influence the professional longevity of a high school science teacher in Florida. $H_3$ – There are statistically significant differences in Level 3 (district variables) that influence the professional longevity of a high school science teacher in Florida. $H_4$ – When tested in a hierarchical multiple regression, there are statistically significant differences in Level 1, Level 2, or Level 3 that influence the professional longevity of a high school science teacher in Florida.

The professional longevity of a Floridian high school science teacher is the dependent variable. The independent variables are: (Level 1) a teacher's sex, age, ethnicity, earned degree, salary, number of schools taught in, migration count, and

various years of service in different areas of education; (Level 2) a school's geographic location, residential population density, average class size, charter status, and SES; and (Level 3) a school district's average SES and average spending per pupil. Statistical analyses of exploratory MLRs and a HMR are used to support the research hypotheses.

The final results of the HMR analysis show a teacher's age, salary, earned degree (unknown, associate, and doctorate), and ethnicity (Hispanic and Native Hawaiian/Pacific Islander); a school's charter status; and a school district's average SES are all significant predictors of a Florida high school science teacher's professional longevity. Although statistically significant in the initial exploratory MLR analyses, a teacher's ethnicity (Asian and Black), a school's geographic location (city and rural), and a school's SES are not statistically significant in the final HMR model.

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## DEDICATION

This work is dedicated to my loving family. To Annette, my loving wife, you have been my cheerleader throughout this entire process. Your everlasting patience and love throughout this endeavor has kept my feet on the ground and inspired me to keep going. To my children, you have all been so supportive when Daddy had to work and study. I am so glad this is being completed now and not when you all are older. I can't wait to see what wonderful children you will grow up to be.

I would like to further dedicate this to my mother (Joan) and father (James, Sr.). School is finally done! After twenty-five plus years, I think I will put the books down for a while (maybe). Thank you for your support and encouragement throughout my life. Thank you for teaching me honor and integrity. Thank you for never letting me take the "easy way" to complete an assignment and for giving me challenges to overcome.

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*The fear of the LORD is the beginning of knowledge* (Proverbs 1:7).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

LIST OF ABBREVIATIONS

| | |
|---|---|
| *%FRL* | Percentage of Free/Reduced Lunch |
| *EDW* | Education Data Warehouse |
| *FLDOE* | Florida Department of Education |
| *HMR* | Hierarchical Multiple Regression |
| *MLR* | Multiple Linear Regression |
| *NAEP* | National Assessment of Educational Progress |
| *NCES* | National Center for Education Statistics |
| *SASS* | School and Staffing Survey |
| *SES* | Socioeconomic Status |
| *SPSS* | Statistical Package for the Social Sciences |
| *TIMSS* | Trends in International Mathematics and Science Study |

# CHAPTER I – INTRODUCTION

## Nature of the Problem and Rationale

According to the Trends in International Mathematics and Science Study (TIMSS), when compared to other nations of the world, the United States often ranks in the top 10 countries in student scientific knowledge, behind countries such as the Republic of South Korea, Singapore, and the Russian Federation. However, with only 56% of students reporting they like to learn science, the 2011 TIMSS Report ranks the United States as twenty-first in a list of countries (which participated) whose students appreciate learning science (Martin, Mullis, Foy, & Stanco, 2012). This knowledge causes questions to arise. Why is a large population of students (44%) apathetic toward learning science?

One conclusion given by Robert R. Bryan, a mathematics professor at the University of Georgia, is that students regard science class as “boring” (Bryan, Glynn, & Kittleson, 2011). When further discussed, it is revealed students believe science class is “boring” because their classes are taught by inexperienced teachers who do not motivate their students to learn and who are often unknowledgeable about the content (Bryan et al., 2011). From these findings, serious questions come to the surface. Although a teacher’s personality varies from setting to setting, why are science teachers viewed negatively in the eyes of the students? What common factors lead to these teachers being characterized as “boring”?

Part of the answer to this question is that the professional longevity for secondary science teachers is low. Teacher attrition researcher at the University of Pennsylvania, Richard Ingersoll, stated:

> Contemporary educational theory holds that one of the pivotal causes of inadequate school performance is the inability of schools to adequately staff classrooms with qualified teachers. This theory also holds that these school staffing problems are primarily due to shortages of teachers, which, in turn, are primarily due to recent increases in teacher retirements and student enrollments. (Ingersoll, 2001, p. 499)

As Ingersoll concluded, a primary reason for the poor performance of students in the United States, across all subject areas, is the lack of qualified teachers. Ingersoll further concluded that the situation is due to high student enrollments and teacher retirements. But is this an accurate portrayal of the situation?

The professional longevity of science teachers is extremely low. As shown by Ingersoll and Perda (2010), 56% of American public high schools reported science-teacher vacancies during the 1999–2000 academic year, and 18% of these schools reported having difficulties hiring qualified science teachers. So it is reasonable to ask whether public high schools in Florida face these difficulties. Are Florida public high schools struggling to retain quality science educators? If so, are the state’s public high school administrators attempting to determine what factors influence the professional longevity of their science teachers? Although studies reveal a high attrition rate for high school science teachers (Ingersoll, 2001; Ingersoll & Perda, 2010), there is a paucity of current literature targeting a comprehensive view of factors influencing the professional longevity of high school science teachers. Therefore, it is impossible to know what specific factors influence the professional longevity of secondary science teachers in public high schools, whether in Florida or across the country.

The science teacher is the frontline soldier and advocate for science education. Therefore, trained and competent science educators are necessary for the effective teaching of students in the school systems of the United States. However, some researchers question the effectiveness of current practices for recruiting, training and retaining science educators (Demir & Abell, 2010; Walsh, 2001). The following paragraphs offer a snapshot of the state of science education in the United States.

## Background and Significance

Each year many science education undergraduates complete their education and pursue professional careers. However, many science education graduates never enter the classroom to teach. Ingersoll and Perda (2010) conducted a study which showed that, at the beginning of the 1999–2000 academic year, only 9% of the new teaching workforce in science education came from colleges of education. That finding alone suggests that most new recruits in science education in the United States are not graduates of science education programs, but from other recruitment arenas.

Because of the supply shortage of science educators from schools/colleges of education, high schools in the public sector are becoming creative in their hiring. Many Florida school districts now permit prospective teachers to possess only a degree in the natural sciences for initial entrance into the public school system (Florida Department of Education, 2014). For example, a research biologist, chemist, or physicist would be permitted to teach in the public sector with a conferred degree in the sciences. According to several researchers, these individuals are often called second-career educators (Chambers, 2002; van Driel, Beijaard, & Verloop, 2001).

Second-career high school science teachers typically are professional scientists who desire to give back to their communities and therefore either leave their professions or work part-time as teachers in their local public schools. According to Ingersoll and Perda (2010), during the 1999–2000 academic year, 31% of the math and science new-hire workforce consisted of newly qualified, non-education degree holders. According to the School and Staffing Survey (SASS) directed by the National Center for Education Statistics (U.S. Department of Education, 2011), 73.6% of surveyed high school science teachers were certified in their subject areas. However, the report states that certified teachers "include all teachers, regardless of whether their major was held within or outside the school/college of education" (U.S. Department of Education, 2011, n.p.). A summary of these data are found in Table 1.

Table 1

*Public High School Teachers by Main Assignment: 2007–2008*

| Selected main assignment | No. of teachers | Major in main assignment[a] | | |
|---|---|---|---|---|
| | | Total | Certified[b] | Not Certified |
| Science | 119,800 | 84.0[c] | 73.6 | 10.4 |
| Biology/life sciences | 53,800 | 76.1 | 60.2 | 16.0 |
| Physical science | 58,100 | 48.5 | 39.5 | 9.0 |
| Chemistry | 24,500 | 48.2 | 36.8 | 11.4 |
| Earth sciences | 8,500 | 33.2 | 27.2 | 6.0 |
| Physics | 8,800 | 57.7 | 42.7 | 15.0 |

Note. Source: NCES, 2011. [a]Includes all teachers, regardless of whether their majors were within or outside schools/colleges of education. Majors in main assignment are credited if they were held at the bachelor's degree level or higher. [b]Includes teachers with regular/probationary certification in-subject and at the secondary level. [c]The remaining 16% are teachers who earned degrees outside their main assignment areas and are therefore teaching out-of-field.

On the surface, these data seem exceptional in that only 10.4% of reporting teachers lack certification in their respective fields. However, Table 1 does not reveal the number of reporting teachers who are science education graduates. Of those teachers reporting they are certified in their subject areas, it is unknown how many are graduates of colleges/schools of education. Moreover, the total number of teachers listing their undergraduate majors in the sciences is 84%. The remaining 16% of the reporting teachers hold degrees outside the sciences and are therefore teaching out-of-field. From this we can infer the possibility that a fairly sizable group of science teachers in the United States are either unqualified to teach in the sciences or are not trained in pedagogical techniques from a school or college of education.

Another issue facing science education is retaining effective, qualified teachers. Ingersoll and Perda (2010) conducted a study in which 56% of public high schools had to fill vacancies in their science departments during the 1999–2000 academic year. Why are over one-half of the public schools in the United States in need of science teachers? Ingersoll and Perda (2010) answer this question, and their points are summarized as follows:

1. The primary reason for vacancies in schools is due to preretirement losses of teachers.
2. The education systems do not have surpluses of science educators on standby, as they typically do for other subjects.
3. Teacher production and recruitment strategies do not address staffing problems other than filling vacant positions.

One point I wish to address further is the preretirement loss of teachers. Of the studies conducted, the data suggest that 23.3% of new teachers leave the teaching profession within their first three years (U.S. Department of Education, 2004). In another study, Ingersoll (2003) concludes that more than 50% of new teachers leave teaching within their first five years of employment. Why do science teachers leave at such an alarmingly high rate?

## Purpose of the Study

With this snapshot of the state of the nation's recruitment, training, and retention of science educators, I am concerned about how the State of Florida compares to the rest of the nation when it comes to its science educators. According to recent data collected by the U.S Census Bureau (U.S. Census Bureau, 2014), Florida is considered to be one of the "Big Four" (California, New York, and Texas are the other three) states because of their populations. Therefore, it is reasonable to conclude that many other states may look to these "Big Four" states as models for K-12 education. Within recent years, however, Florida's test scores within the upper level sciences have dropped below national averages (U.S. Department of Education, 2012). Florida's students have scored at or below the high school national average in almost every subject, including science. A summary of these data are seen in Table 2.

From Table 2, a trend appears revealing that student achievement declined from elementary through middle school and into high school. Several education advocates and lawmakers have offered generalizations to explain the drop in student achievement. These include insufficient spending per student, large student-teacher ratios, and a high number of Title I schools. Of all these generalizations, only one appears to apply to Florida. The state spent an average of $9,060 per student in 2011–2012, has a 15.2

Table 2

*Summary of NAEP Results from Florida*

| | | | | | State achievement levels | | |
|---|---|---|---|---|---|---|---|
| Subject | Grade | Year | State Average | National Public Average | Percent At or Above Basic | Percent At or Above Proficient | Percent At Advanced |
| Mathematics | 4 | 2013 | 242 | 241 | 84 | 41 | 6 |
| | | 2011 | 240 | 240 | 84 | 37 | 5 |
| | | 2009 | 242 | 239 | 86 | 40 | 5 |
| | 8 | 2013 | 281 | 284 | 70 | 31 | 7 |
| | | 2011 | 278 | 283 | 68 | 28 | 6 |
| | | 2009 | 279 | 282 | 70 | 29 | 6 |
| | 12 | 2013 | 149 | 152 | 60 | 19 | 1 |
| | | 2009 | 148 | 152 | 59 | 19 | 1 |
| Science[a] | 4 | 2009 | 151 | 149 | 75 | 32 | 0 |
| | 8 | 2011 | 148 | 151 | 62 | 28 | 1 |
| | | 2009 | 146 | 149 | 57 | 25 | 1 |

[a]Florida transitioned between the FCAT and FCAT 2.0 for the sciences between the 2011–2012 and 2012–2013 academic years. Data are not reported to NAEP. Source: FLDOE website: http://fcat.fldoe.org/fcat2. Accessed: 10/19/2014.

student to teacher ratio, and 79.5% of its schools qualify for Title I benefits (U.S. Department of Education, 2012). When compared to other states in the nation, Florida's spending per student is considered middle- to higher-range, and its student to teacher ratio is low- to middle-range. When considering its percentage of Title I schools, Florida's rate is rather high. However, its percentage of Title I schools cannot fairly be regarded as a reason for low student achievement, given the number of states with higher Title I percentages and higher-than-national average test scores. For example, Maine has a high number (87.6%) of Title I schools, but in all of its student assessments the state comes out significantly higher than the national average (U.S. Department of Education, 2012).

Florida also has experienced a large exodus of teachers from the public school system in recent years. During the 2012–2013 academic year, over 9,000 teachers left the public school arena in Florida (Florida Department of Education, 2014). This constitutes 5.3% of the total public school teachers in the state during that academic year. Currently, the data do not address how many of those were high school science teachers (Florida Department of Education, 2013). With a narrower focus, we see that the Escambia County School District (ECSD), an economically poor county in the state of Florida, also experienced high rates of attrition in recent years. During the 2012–2013 academic year, the ECSD saw 140 teachers leave the profession (Florida Department of Education, 2013). This number represents 5.2% of the county's total teaching staff, a percentage only slightly lower than that of teachers leaving education in all of Florida (Florida Department of Education, 2013).

Given these clear facts, it is valid to question what has and does occur in the high school science classrooms throughout Florida. Specifically, *could the attrition of high school science teachers in Florida be influencing student achievement*? To answer this question, this study is designed to ascertain what factors influence the professional longevity of high school science teachers in Florida.

## Research Hypotheses

The following research hypotheses are listed below. Together they constitute my attempt to determine what accounts for the professional longevity of high school science teachers in Florida.

1. $H_{01}$ – There are no statistically significant differences in Level 1 (teacher variables) that influence the professional longevity of a high school science teacher in Florida.
2. $H_1$ – There are statistically significant differences in Level 1 (teacher variables) that influence the professional longevity of a high school science teacher in Florida.
3. $H_{02}$ – There are no statistically significant differences in Level 2 (school variables) that influence the professional longevity of a high school science teacher in Florida.
4. $H_2$ – There are statistically significant differences in Level 2 (school variables) that influence the professional longevity of a high school science teacher in Florida.
5. $H_{03}$ – There are no statistically significant differences in Level 3 (district variables) that influence the professional longevity of a high school science teacher in Florida.
6. $H_3$ – There are statistically significant differences in Level 3 (district variables) that influence the professional longevity of a high school science teacher in Florida.

7. $H_{04}$ – When tested in a hierarchical multiple regression, there are no statistically significant differences in Level 1, Level 2, or Level 3 that influence the professional longevity of a high school science teacher in Florida.
8. $H_4$ – When tested in a hierarchical multiple regression, there are statistically significant differences in Level 1, Level 2, or Level 3 that influence the professional longevity of a high school science teacher in Florida.

## Delimitations, Limitations, and Assumptions

It is vitally important to firmly establish the delimitations and limitations for this study, so that broad generalizations are not inferred from the study's results. Since my study targets high school science teachers who left teaching in the Florida school system, the results of the study are limited and may not be transferrable to other states. An important reason for this is that, although Florida's public education system is frequently referred to as a model of education, it is important to remember that each state's public high school science departments enact different policies for their teachers, schools, and districts.

The demographics of my study's population are representative of the demographics of the overall population of the state of Florida and the United States. Although I am studying differences between a teacher's sex and ethnicity as related to their potentiality of leaving the school system, the results should not be interpreted as symptomatic of any person's sex or ethnicity, and certainly should not be a factor used in hiring. This means that, for example, a person's ethnicity should not be included as a hiring factor in the event that his or her ethnic group has recorded a higher rate of attrition than other ethnic groups. The same applies to results from my study involving an individual's sex.

Although I am studying several independent variables (a teacher's sex, age, ethnicity, earned degree, salary, migration count, geographic location, residential population density, socioeconomic status (SES), district-spending per student and SES) as predictors of a high school science teacher's professional longevity, I am aware of and somewhat limited by the fact that there may be other variables that should be considered when predicting the professional longevity of high school science teachers. For example, the data being analyzed are from the academic years 2011–2012 to 2013–2014. During that period, the most significant educational legislation enacted was President Obama's Race To The Top initiative. Another law (passed much earlier) which could be statistically significant is No Child Left Behind and Goals 2000.

There are many forms of attrition teachers may experience during their tenure. These include migration, departure, and retirement. Since I am studying only those teachers who left the profession, I am not taking into consideration factors which may influence a teacher's migration *within* the educational system. However, a teacher's total migration count is included as a predictor variable in this study. Also, I am not distinguishing between those teachers who left the profession and those who retired. In other words, other factors distinguishing retirees from leavers are not considered herein.

Additionally, although the nature of this study attempts to examine factors as predictors of professional longevity, it must be stated that causality for this study could work in both directions. For example, this study does look at predictors (e.g. degree, salary, sex, and ethnicity) in an attempt to determine how long a teacher will serve in the

Florida school system. However, it is also understood that a teacher could also be placed or choose where to go within the Florida school system because of factors, which they may already possess (e.g. degree, sex, years of experience). Therefore, the factor they possess upon entering the school system may or may not accurately predict their professional longevity. It is important to note that although this study focuses on factors as causes of professional longevity, many of these factors could actually determine where the teacher will work within the school system; thereby, changing their predicted professional longevity.

Finally, I assume the data received from the Florida Department of Education (FLDOE) are accurate and thoroughly reported. Since the methods of data collection and reporting can vary over time, it is important to see if similar data elements are consistent throughout the years studied. Where there were inconsistencies, a representative from the FLDOE was contacted to resolve those inconsistencies.

## Definition of Terms

1. Average Class Size – average number of students per class of 9–12 graders
2. Charter School – a non-traditional public school
3. Entrance Training – the quantity of training a teacher received after entering the teaching profession
4. First-Career – any teacher who majored in science education or obtained a general education degree from a school or college of education
5. Geographic Location – the relative location of a school with respect to specific geographic landmarks

6. Migration Count – the number of times a teacher moved between schools during his or her time of employment within the Florida school system
7. Pedagogical Preparation – the quantity of training in the art of teaching before entering full-time in the teaching profession
8. Professional Longevity – the length of time a teacher serves in the school system
9. Public School – a traditional public school
10. Residential Population Density – the relative location of a school with respect to specific centers of urban development or population
11. Salary – the amount of annual payment a teacher receives in U.S. dollars
12. School – the location or building where a teacher teaches
13. School District – a grouping of schools found within a common geographic area, such as a state's county
14. Second-Career – any teacher who has not obtained a degree in science education or general education from a school or college of education
15. Socioeconomic Status – a sociological and economic measurement of a school and/or school district based upon the percentage of students who qualify for free or reduced lunch as permitted under Title IV
16. Spending per Student – the average amount of money the school district spends on each 9–12 grade student
17. Teacher Attrition – the loss of teachers from the teaching profession
18. Years of Service – the number of years one has served in a specific capacity, such as years in the Florida school system, military, or school administration

# CHAPTER II – REVIEW OF LITERATURE

## Professional Longevity of Teachers

For years, the teaching profession was regarded as a worthy and noble calling for anyone who undertook it. One consequence of this was that it was not uncommon for a teacher to remain in the same region, school, or even the same classroom for several years. Many of us probably remember a teacher from our past who stoked in us a sense of aspiration to accomplish something great in our lives. For those who graduated much earlier, it may be that their children were taught by their teachers.

For those teachers, teaching was more than a profession—it was a serious commitment to molding future generations. They viewed teaching as a continual calling that could not be left unanswered. Consequently, teachers who continued their service often received professional benefits while benefiting those they served.

### *Benefits for Long-Serving Teachers*

In almost any occupation, loyalty to one's position brings personal benefits, whether those be financial, positional, or influential. Accordingly, teachers receive benefits in all of these areas. However, a research study conducted by Johnson and Birkeland (2003), found that many lifelong teachers do not put much stock into financial or positional benefits. Rather, they seem more concerned with influential benefits—those benefits they receive from influencing society and ultimately bettering themselves. Three areas lifetime teachers seem to benefit from are (1) they continue to develop professionally; (2) they instruct and influence multiple generations; and (3) they develop an inward sense of purpose and accomplishment.

*Continuing To Develop Professionally*. The continual professional development of a teacher is an almost immediate benefit long-serving teachers experience. Beltman, Mansfield, and Price (2011) stated that the inaugural year of teaching is crucial for the professional development of the teacher. Most teachers will say their first year of teaching is extremely difficult. The same teachers often say that their second year of teaching was better but still problematic. However, by the third year of teaching most teachers get into a routine where they feel comfortable (Beltman et al., 2011). Johnson and Birkeland (2003) showed that as teachers gain more years of experience, they gain more confidence, which in turn leads to further professional development. Eventually fears and trepidations subside, and the teachers are able to expand and refine their teaching materials and techniques.

However, teachers must beware of plateauing. As defined by Milstein, plateauing is when "one's situation is perceived to be stagnant and devoid of challenge" (Milstein, 1993, p. 1). According to Meister and Ahrens (2011), long-serving teachers must be persistently challenged in order to continue to develop professionally in their careers. They further state, however, that many long-serving teachers are capable of avoiding a plateau in their pedagogical techniques. As teachers continue in the profession, they will learn techniques that help them reach the labeled or unreachable students, inspire students to achieve more, and promote a productive learning environment for students. According to a study conducted by Bobek (2002), lifetime teachers take ownership of their occupation and set personal goals to reach as they advance. These teachers feel confident in how and what they are doing and continue to seek ways to improve their pedagogical skills.

*Instructing and Influencing Multiple Generations*. Another benefit enjoyed by long-serving teachers is that they have the potential to teach multiple generations of students—even some from the same families. Bobek (2002) further showed that teachers who have the ability to effectively communicate with parents and students develop a resiliency and a desire to stay in their occupation. Quite often, lifetime teachers will teach all the siblings of a particular familial group (Bobek, 2002). The benefit, then, is that lifetime teachers know they have poured essentially all their experience into one familial group that will benefit thereby. In other words, the lifetime teacher's influence will expand as the family expands. As the family expands, however, the possibility increases that the same teacher will instruct the children of their former students. This benefits the teacher in that he or she achieves a sense of approval from former students (Johnson & Birkeland, 2002). If a former student is willing to place his or her child in the classroom of a former teacher, the lifetime teacher will gain a sense of approval and satisfaction from such a show of trust.

*Developing a Sense of Purpose and Accomplishment*. A final benefit that long-serving teachers gain is development of a sense of purpose and accomplishment. This often occurs vicariously, through former students. Johnson and Birkeland (2003) show that lifetime teachers develop a sense of purpose when they see the difference they make in the lives of their students and in the lives of those with whom their students come in contact. This sense of purpose is sometimes referred to as teacher identity. Oruç stated in his research:

> As part of society, teachers experience many opportunities to both change themselves, and to be changed by the influences around them. The students they

> teach, the preservice preparation, and in-service professional development they receive, and sometimes the profession of teaching as a whole are important factors in shaping their identity (Oruç, 2013, p. 207).

Whether this difference is at a federal, state or local level, a long-serving teacher will realize that his or her purpose is to help contribute to the betterment of society as a whole.

A sense of accomplishment may come with the successful influence of their students and society, but long-serving teachers also achieve this from seeing their students succeed. According to DiPaola and Hoy (2005), lifetime teachers are “personally invested in the success of students and take responsibility for student learning” (p. 41). When former students succeed, teachers feel as if they are part of their students’ success. Although a former student’s success may not be directly connected to what he or she learned in the classroom, the lifetime teacher will feel that the student’s time in class has contributed to his or her student’s success. Kim and Loadman (1994) describe it best when they state:

> People become teachers because they are interested in children and want to help develop a youngster’s potential and to perform a special service to the community. Teaching is an opportunity to serve society, and the teacher is a moral agent dedicated to serving the public (Kim & Loadman, 1994, p.11).

Another avenue in which teachers gain a sense of accomplishment is through public recognition of their hard work and dedication to the profession (Bobek, 2002). Many times the work teachers do is taken for granted and often overlooked by people in authority within and outside of the school system. However, according to Meister and Ahrens (2011), when teachers are recognized for their achievements, they gain a sense of accomplishment to the point that they do not want to be removed from their classrooms. Essentially, the teachers receive revitalization that seems never to fade in the face of adverse circumstances (Bobek, 2002).

Although this is not an exhaustive list of the different benefits the lifetime teacher experiences, these specific instances give us a glimpse of how these teachers view the seriousness of their occupation. Though these benefits are intangible, they often give dedicated teachers the desire to continue in the profession. Teachers, however, are not the only beneficiaries of a lifetime of service in education. The educational system also benefits from long-serving teachers.

*Benefits for the Educational System*

When teachers stay in their occupation for long stretches of time, the educational system benefits. With the ever-increasing demand to make schools more like miniature universities (Lynch, 2000), schools are asked to perform more tasks than that which they are capable of performing. Yet according to Beltman, et al. (2011), schools that have large populations of lifetime teachers see continual success throughout the school year, despite such heightened expectations. Overall, there are many benefits the school system receives because of lifetime teachers. Additionally, Yeh (2009) showed that schools not only prosper academically from lifetime teachers, they also prosper economically. I will discuss three benefits which are significant to the success—the betterment—of the educational system at large. Indeed, without these benefits—the ability to *maintain programs*, gain *student stability and security*, and gain *parental confidence*—the public education system in the United States could crumble.

*Schools Maintain Programs*. The modern public high school has become essentially a miniature university (Lynch, 2000) and is required to offer different academic majors and extracurricular electives. In order to offer specific programs and electives, the school is required to maintain a capable, qualified faculty. If a school is unable to keep a qualified faculty member, it may be required to suspend academic programs and extracurricular courses. Therefore, if teachers are willing to commit lifetimes to their schools, administrators will be able to maintain and possibly expand programs (Beltman et al., 2011). However, this will only occur if teachers are willing to stay in the particular schools where these programs exist.

*Students Gain a Sense of Stability and Security*. Another added benefit for the educational system when long-serving teachers commit to their schools is that students gain a sense of stability and security. In a study conducted by Sybrant (2012), it was shown that students in school systems gain a sense of security from the longevity of superintendents. Therefore, according to Sybrant, it is reasonable to conclude that students, being part of the school system, also gain a sense stability and security from the presence of lifetime teachers.

Essentially the school becomes an extension of a student's familial group. In a study conducted by Adderley, Kennedy, and Berz (2003), one of the reasons students in a high school music course felt like they were at home was that their teachers had many years of teaching experience. It is appropriate to conclude, then, that if students see the same teachers walking the hallways and teaching each year, students will become secure in the knowledge that they know who is in the school. At the other extreme, however, if vast numbers of teachers are coming in or leaving the school each year, students will never develop a sense of security and stability from their school setting.

*Parental Confidence in School System Increases*. Not only do students gain a sense of stability and security at school when long-serving teachers are prevalent, but parents also gain confidence in the school system. When parents have confidence in the school system they are more apt to support teachers and assist in the classroom (Bobek, 2002). As Hoover-Dempsey, Bassler, and Brissie (1992) concluded in their study, when parents know their children are safe in the hands of an experienced teacher, they will be more willing to support the school in various activities, fundraisers, and volunteer opportunities. It is appropriate to conclude, then, that if parents do not develop trust in the school system, they will become critical of school policy and teachers. This could result in the withdrawal of students and decreased support for the public education system.

### *Professional Longevity*

Whenever we hear the words professional longevity we think of someone who remains in an occupation for an extended period or someone who has lived a long, productive professional life. Although this is the case with a teacher's professional longevity, this term carries with it much more. According to Quinn (2011), a teacher's professional longevity can also be defined by his or her displays of durability, endurance, and permanency.

A durable teacher is someone who is capable of performing various tasks as part of his or her responsibilities (Howard & Johnson, 2004). For example, a teacher may not only teach, but may also coach, supervise students during extracurricular activities, and serve as a committee advisor or student class or club sponsor. The endurance of a teacher can be seen when the teacher never seems to tire or quit regardless of the circumstances (Beasley, 2013; Kent, Green, & Feldman, 2012). These teachers are always present when they are needed and they are capable of performing their duties for long periods. The permanency of a teacher is more of an intangible quality. It carries with it the idea that a teacher is dependable and will always be present in the school. According to Beasley (2013), permanency carries the idea that teachers are essentially in residence at the school and never seem to leave. So a teacher's professional longevity is more than serving a given number of years in education. Professional longevity carries with it character qualities such as dependability, endurance, and durability.

## Attrition of Teachers

Teacher attrition occurs when teachers either leave their occupation or transfer to another area of education, thereby causing undue stress on the educational systems they once supported. Obviously a school cannot keep the same teachers forever, and new teachers must enter the profession. However, a decrease in teachers' professional longevity has been seen in recent years. According to Ingersoll (2003), as many as 50% of teachers with less than five years of experience end up leaving the teaching profession. The National Center for Educational Statistics (U.S. Department of Education, 2004) reported that 23.3% of new teachers leave within the first three years of teaching. In many professions, ongoing career changes are considered typical, and many workers do not make plans for long-term employment in one place (Johnson & Birkeland, 2003). But with teachers, it is important to understand that a teacher's professional longevity is a positive thing, and therefore it is useful to determine whether the level of teacher attrition is changing. The following paragraphs define various types of teacher attrition, provide examples of teacher attrition, and address the current trends in professional longevity and attrition in the public school systems in the United States.

*Types of Teacher Attrition*

Before we continue, it is important to define our terminology as to what we mean by *teacher attrition* and *professional longevity*. On the surface, the two concepts seem to be antonyms of each other. However, slight differences are important to note.

*Migration Attrition*. The first type of teacher attrition I will discuss is migration attrition. According to Ingersoll and Perda (2010), migration attrition is defined as the transferring of a faculty member from one school to another within the same educational system or to another location where he or she still is considered to be working in the same profession. For example, a teacher may leave a public school in one district to work at another public school either within or outside of his or her original school district, or leave a public school to teach at a school outside the public sector. Although the teacher's new school is outside the public education sector, the teacher is still teaching and therefore has not left the profession altogether. Therefore, the teacher is classified as a *migrant*.

*Departure Attrition*. The second type of teacher attrition I will discuss is departure attrition, also referred to as pre-retirement attrition. As defined by Ingersoll and Perda (2010), departure attrition is when a teacher leaves the education profession altogether in order to pursue either a different career path or retirement. In 2003, it was shown that within the first five years of teaching, between thirty-three and fifty percent of new teachers left the occupation of education (Darling-Hammond, 2003; Ingersoll & Smith, 2003b). Although all types of attrition hinder the public education system, this type of attrition seems to carry with it a negative stigma because of the vast number of individuals found therein. When analyzing the intentions of this group of teachers, it becomes obvious that teaching is not an easy profession (Ingersoll & Perda, 2010). However, this exodus of teachers is not confined to the borders of the United States. Liu and Onwuegbuzie (2012) conducted a study in China in which teachers gave reasons for leaving the profession which were very similar to those given by their American counterparts: high stress levels, low salaries, inadequate breaks, heavy workloads, boredom with teaching, and low confidence in the education system. Thus, we can conclude that regardless of nationality, departure attrition occurs in great numbers every year within the public school system. Therefore, it becomes absolutely necessary to develop effective strategies for combating and stemming the tide of departure attrition.

*Examples of Teacher Attrition*

Although I have defined different aspects of teacher attrition and professional longevity, there are many avenues with which teacher attrition can exhibit itself. One of these is how an individual views teaching as an occupation. Oftentimes, individuals view teaching as short-term flings, or stepping-stones to their next career opportunities (Johnson & Birkeland, 2003). I will look at four different examples of teacher attrition from the last decade of education. These examples of teacher attrition include the teacher taking an “easier” position elsewhere, moving into an administrative role, leaving the profession before retirement, and retirement.

*Teacher Takes “Easier” Position*. Being the teacher in the classroom is more difficult than many people realize. This can be especially true if the teacher works at a school that has been deemed by the community as an underperforming school. According to Chrisman (2005), underperforming schools are institutions that are not known for their academic achievement, but rather for their academic underachievement. Most often these schools exist in large urban areas where the demand for education is quite high. Teachers will often consider positions at these schools to be too demanding on their professional and personal lives. Johnson and Birkeland (2003) stated that these teachers “do not feel effective in the classroom, and they attributed most of their troubles to the shortcomings of their schools” (p. 597). Whenever possible, these teachers, unable to endure the hardship of teaching at these schools, will look for employment at other schools within their local areas.

Johnson and Birkeland (2003) further stated that teachers who move to different schools will often move to schools that teach more affluent students. Often it is the case that if a teacher teaches at the “worst school in town,” he or she will instead seek to gain employment at a more prestigious school. As reported by Berry (2004), this attempt to gain an easier position often leads to an imbalance in academic excellence across school districts, since underperforming schools are unable to easily attract and maintain quality educators.

*Moves into Administrative Role*. Quite often teacher attrition occurs because a teacher decides that the classroom is not for him or her, and therefore feels the need to leave (Brewer, 1996). However, the teacher still feels the need to contribute to the training of the next generation, and looks for another position he or she is able to fill within the education system. This typically results in the teacher looking for a position not below his or her current rank. So the only positions above them would be at the administrative level. According to Brewer (1996), teachers who cannot endure the classroom feel they would be more suited handling the day-to-day administrative affairs of school management. Unfortunately, from these findings it can be concluded that in such a situation a potentially qualified teacher goes missing from the classroom, and a replacement must be found.

*Leaves Profession before Retirement*. Leaving the profession altogether is the most frequent source of teacher attrition (Ingersoll, 2001). Whether this is the result of the two previously mentioned types of attrition being unavailable or the teacher's own personal reasons is not known. However, Ingersoll and Perda (2010) showed that teachers, especially in science, leave the profession before retirement age at an alarming rate. This type of attrition is the most easily accomplished by the teacher and places schools in the extremely difficult position of having to find new teachers. The overall result is the loss of another potential teacher who could have inspired students for future generations. Johnson and Birkeland (2003) stated that "These teachers left because they were overwhelmed by the demands of the job and saw few prospects for improvement or success, either in their school or in other public schools" (p. 594).

*Retires from the Profession*. The final avenue of teacher attrition is retirement. This occurs when a teacher reaches retirement age and decides to either stop working or pursues another occupation in his or her later years. However, it is key to note that retirees are teachers who put a considerable number of years into teaching (Macdonald, 1999). They are very different from teachers who invest only a few years in teaching and then leave (Ingersoll & Perda, 2010). It is easy to conclude, then, that retiree teachers have invested several years of their lives in teaching and can worthily be called lifetime teachers. Although the number of retired teachers does contribute to the overall attrition of teachers, according to Ingersoll and Perda (2010) and Macdonald (1999), their numbers are far smaller than those who quit outright.

*Trends in Teacher Attrition*

With these definitions established, our discussion now turns to the current trends in teacher attrition and professional longevity within the United States public education system. Over the last eighty years, trends in teacher attrition and longevity seem rather fluid (Ingersoll & Perda, 2010). Sometimes these changes are gradual and other times extreme. However, both teacher attrition and longevity have shown a consistent trend over the last *thirty* years. That is, teacher attrition has increased greatly—in some years, exponentially. Therefore, I will explore the problem of attrition itself, the steady and alarming decline in the number of recruits from schools of education, and overall teacher shortages due to increased staffing needs.

*Attrition Continues to Rise*. Of great concern to many in education are the continual increases in teacher attrition and the subsequent decreases in teacher longevity within the United States' public education system. According to Ingersoll (2001), teacher attrition is continuing to rise each year and shows little to no sign of subsiding. Some professional educators feel that, if not kept in check, the public education system may implode, meaning it will no longer be sustainable. According to Hill, Pierce, and Guthrie (1995), increasing attrition rates could result in the collapse of the American public education system. Based upon the reviewed studies, I have chosen four areas that place stress on the public education system. I will discuss the impact of teachers' migration, quitting, retiring, and the presence of fewer recruits and how these affect the American public education system.

*Migration is a Minor Contributor*. According to Ingersoll (2001), teacher migration is a small contributor to increasing teacher attrition in the United States. However, this is not to say that the number of teachers migrating is small. On the contrary, over half of all teacher attrition is due to teachers moving between schools (Ingersoll, 2001). However, migration is a small contributor when it comes to the stresses placed on the education system. As Guarino, Santibañez, and Daley (2006) state, "While this type of teacher turnover represents 'attrition' from individual schools or districts, it does not represent overall attrition from teaching" (p. 185). It is easy to see how this is true, as migrant teachers actually stay within the system, and therefore are able to contribute in some way. From this statistic, it is safe to conclude that migrating teachers fill other positions, such as substitute teachers, administrators, other various service areas within the system, or they end up teaching at different schools. Therefore, although teacher migration may induce stress on the system, the stress is minimal because the teacher still contributes to the education system.

*Quitting is the Greatest Contributor*. The greatest stress on the public education system is seen when teachers simply quit. At the conclusion of every academic year, thousands of teachers leave the teaching profession. During the 1999–2000 academic year, approximately 173,439 teachers quit the education profession (Borman & Dowling, 2008). This mass exodus of teachers not only burdens the school system with teacher shortages, but also does financial damage. According to the Alliance for Excellent Education (2005), each time a teacher quits the public education system; it costs approximately 30% of the leaving teacher's salary. Based on the average teacher's annual salary of $56,383, reported by the USDE (U.S. Department of Education, 2013), it would cost the school system more than $2.9 billion, given the 1999–2000 attrition levels. However, it is not unusual for teachers to leave before the school year is finished. In either instance, this places the school system in the position of having to find new teachers to fill vacant positions. Although this is a stress for those in administrative positions each year, one of the greatest problems is that the number of teachers quitting each year seems to be growing. Additionally, Gaurino et al. (2006) discovered that quitting the profession is extremely high among new teachers when compared to their more seasoned counterparts. Therefore, it is easy to conclude that the demand for qualified educators continues to surge as the number of teacher leaving the system increases.

*Number of Retirees Increasing*. More teachers are reaching retirement age and are leaving the workforce. The so-called "baby-boomer" generation of teachers is reaching retirement age and they are steadily leaving the education system. As the number of retirees continues to climb, it becomes necessary for school administrators to find more and more qualified teachers each year (Ingersoll & Perda, 2010). Because of this, many school districts actually experience a deficit of teachers and are not able to continue offering small class sizes. According to Ingersoll (2001), current teachers are now faced with the inevitability that their classroom populations are going to grow. However, it would be inappropriate to fault these teachers for retiring. Many have committed a lifetime of service to the education system. However, it is correct to conclude that with more retirees each year, the responsibility for pulling in new recruits from across the nation becomes even more critical.

*Fewer Recruits from Schools of Education*. With the decrease in professional longevity in the classroom, administrators are in need of recruiting new teachers from various schools of education across the United States. Weiss (1999) stated that administrators, nationally and internationally, are often met with disappointment at the number of recruits from schools of education. Shortages in the available workforce are influenced by an increase in demand and a decrease in supply of new recruits (Guarino et al., 2006). From these facts, it is fair to conclude that fewer undergraduates are choosing to major in a field in education, or they are deciding not to become teachers upon completion of their degrees.

The question which now puzzles many of us is “why”? Why do undergraduate students choose not to major in an area of education or not to become a teacher upon graduation? To answer these questions, I will address three specific areas that plague the teaching profession: the stigma of teaching as a second-class profession, low salaries, and students changing majors while in college.

### *Stigma of a Second-Class Profession*

Unfortunately, many undergraduates do not choose a major in the field of education because of the negative modern connotations associated with being a teacher. The famous literary author George Bernard Shaw memorably wrote in *Man and Superman*, “He who can, does. He who cannot, teaches” (Shaw, 1903, p. 334). These sentences have stuck with mankind and have almost become a mantra for those who despise professional educators. Unfortunately, this mantra is ingrained in many students entering colleges and universities across the United States. Darling-Hammond (2001) concluded that the public views teaching as “relatively simple, straightforward work, easily controlled by prescriptions of practice . . . reinforced by the ‘apprenticeship of experience’ that adults have lived through during their years as students in school” (p. 761). This observation, unfortunately, confirms the ubiquity of Shaw’s famous quote. Because teachers have this stigma of being second-class in the eyes of the public, many undergraduate students do not want to bear the “shame” of being an education major. Additional studies conducted by Johnson and Birkeland (2003) and Hoffman (1981) support the fact that teaching is viewed as a low-status occupation, being compared to childcare, and an occupation suitable for women only. Other authors, such as Kristof (2006), only confirm this stigma when stating that anybody with enough experience can be a teacher. This message contributes to the shortage of qualified teachers in this country. Although this is an awful stigma to attach to such a noble profession, it is not the only stress facing education majors.

### *Salary Too Low to Attract Recruits*

Because of the economic condition of the United States public education system, schools are not able to pay teachers what they are worth to this country (Ingersoll & Smith, 2003a). Although many teachers say they are well-salaried, there are many others who are verbose about their lack of compensation. It is this voice that is given most attention. Stagnitta (2014) studied teacher unions all across the United States and found that one of teachers’ biggest complaints is their lack of appropriate wages. Unfortunately, we can conclude that this complaining trickles down into the arena of potential teachers, resulting in them wanting nothing to do with education as a career.

In 2012, the average salary of a public school teacher in the United States was $56,383 (U.S. Department of Education, 2013). Many would consider this a decent salary. However, there is a common belief that teachers are not paid enough to have comfortable lifestyles or support families. Although a high salary is important to many people, according to Ingersoll and Perda (2010) this does not fully explain why so many education majors never enter teaching upon graduation, or why they change majors.

### *Education Majors Change Degree Field*

Another factor which influences the lack of new recruits from colleges of education is drop-out by students pursuing education majors while in college, or not pursuing teaching careers after graduation. According to Quinn (2011), many new college students often have grandiose ideas of what their chosen majors or future occupations will entail. However, upon completing their course requirements, many students elect a different course for their lives. In general, degrees in education demand more from students each year, including student teaching responsibilities, preparation of daily lesson plans, and teacher-student interactions (Darling-Hammond, 2010).

Not only do education majors need to master content knowledge and pedagogical techniques, they also must have solid emotional stability. According to Rots, Aelterman, Devos, and Vlerick (2010), an education major is challenged every day emotionally—which can influence any teacher in training. An education major does not truly get into the trenches of his or her degree until the junior year of college. This may be when many students realize that teaching is not the career for them. Student teachers oftentimes experience a reality shock so severe that they lose any desire to enter the classroom upon completion of college (Brouwer & Korthagen, 2005; Sinclair, 2008).

Because of this experience, many education students change their majors and pursue the quickest route to graduation. Yet, this is surprising considering the evidence that Yost (2006) provides, which is that many undergraduate teacher education programs foster a spirit of resiliency and persistency in new teachers. On the other hand, according to Chingos and West (2010), many students press through their education degree requirements, teach for a short period, and then proceed to a graduate degree in another field. It is clear that both of these instances result in fewer qualified, trained teachers entering the classroom.

*Overall Teacher Shortages*. Results from research studies show that a plethora of factors are responsible for teacher shortages across the United States and cannot be narrowed down to a single factor (Ingersoll & Perda, 2010; Ingersoll & Smith, 2003a). Such factors include, but are not limited to, higher birth rates; immigration; teacher retirement, attrition, and salaries; and changes in school policies on class sizes and graduation requirements (Henke, Chen, & Geis, 2000; Johnson & Birkeland, 2003).

Although the previous discussion is not exhaustive in its reasons for lack of new qualified teachers in the United States, it does offer a glimpse into the major areas of work needed to increase the supply of new teachers. Ingersoll and Perda (2010) stated that since the supply of new teachers is dwindling, this places stress on the school system in its functioning. This is especially true in the wake of the No Child Left Behind Act, which requires schools to hire and retain quality teachers (Malloy & Allen, 2007). It is easy to conclude that without the ability to staff vital areas of the school system, public schools in the United States will struggle to maintain staffing levels and small class sizes, and continue programs they have promised to provide to their students.

### *Schools Constantly Recruiting Teachers*

As mentioned above, schools constantly need to fill positions, just as any business constantly looks for employees to hire. Ingersoll (2001) stated that some public schools are fully staffed, but these schools are in the minority and most are in dire need of well-qualified faculty. What exacerbates the situation even further is that, due to the vast number of qualified teachers needed each year; many schools cannot afford to be selective in their hiring practices (Johnson & Birkeland, 2003). Many businesses have cycles of hiring new employees, but the public school system seems to have a steady stream of needs. This continual need is compounded by the facts mentioned above. Since there are not enough new recruits graduating and faculty members can easily leave, schools never seem to stop hiring new teachers. So we can conclude that there is a never-ending need for more teachers in the public school system.

### *Class Sizes Increasing Due to Lack of Teachers*

Another sign that staffing needs are increasing is that the average classroom size is increasing in the school system in several regions of the United States. This is especially true in science and mathematics courses, which saw a 69% growth in student enrollment due to increases in science and mathematics graduation requirements (Ingersoll, Merrill, & Stuckey, 2014). Stagnitta (2014) reported that many teachers and schools wish to have small class sizes, about twenty students per class—and feel that teacher unions should have greater authority over class size. In the 1970s, class sizes began to surge in growth, only to see an overall decrease from 1980 to 2008 (Ingersoll et al., 2014). Since 2008, however, class sizes have again begun to increase.

### *School Programs Suspended*

A tragic result of the lack of teachers is the necessity for schools to cut programs because of their inability to staff or finance these areas (Oliff & Leachman, 2011). These areas range from offering specified extracurricular courses such as accounting, marine biology, or advanced calculus, to student performance possibilities such as band, sports, or drama. According to Lynch (2000), what makes this even more difficult is that schools are offering majors that students can select. Oliff and Leachman (2011) state that problems occur because qualified faculty members are not instructing students in academic areas. This causes us to question if students are, indeed, getting a quality education.

#### *Complexity of Teacher Attrition/Longevity Studies*

Although studies regarding teacher attrition have been conducted for the last thirty years, the complexity of these attrition studies continues to grow. The different number and combination of viewpoints and factors to study have become entangled over the decades. According to Schaefer, Long, and Clandinin (2012),

> One could frame research into teacher attrition by thinking about the reasons teachers give for leaving teaching such as salary or family commitments. One might also attend to the social dimensions of attrition, for example, thinking about how school culture protects against, or contributes to, the loss of teachers. One could also look at attrition by examining who leaves teaching and when they leave, for example, by considering personal characteristics or demographics. (p. 107)

As seen above, the complexity surrounding teacher attrition studies is that there is not one set of factors that can predict teacher attrition. Although several successful studies exist that can predict a teacher's attrition, there are always more factors that could be added to these studies (Grayson & Alvarez, 2008).

Not only are the factors that need to be studied numerous, there is not a set methodology to conduct these studies. Contributing factors within the realm of education have a tendency to exist on multiple levels (Field, 2009; Staiger & Rockoff, 2010). The presence of factors on multiple levels requires methodologies of a hierarchical nature in order to properly determine the effects of these factors on a teacher's professional longevity (Field, 2009; Ware & Kitsantas, 2011).

## Teacher-Level Factors in Previous Attrition/Longevity Studies

As attrition studies continue to become greater in complexity, it is important to understand that there indeed are several levels on which factors that influence teacher attrition can reside. One is the teacher-level. This includes factors that the teacher is either in control of or qualities of the teacher (Field, 2009). Such factors include, but are not limited to, a teacher's age, sex, ethnicity, and degree.

### *Age*

As with all occupations, the age of employees can influence how long they will serve. However, studies involving teacher attrition have revealed an interesting effect of age. That is, at both ends of the spectrum, young and old, teachers seem to be leaving the workforce in the greatest numbers (DeAngelis & Presley, 2011; Ingersoll, 2001). Not only are over 50% of new, young teachers quitting the profession within their first five years of teaching (Ingersoll, 2003; Keigher, 2010; McDonald, 1999), but the number of retirees is steadily increasing (Ingersoll & Perda, 2010). What is even more intriguing is one study by Skaalvik and Skaalvik (2011) which showed that the average age of their population of teachers was 45. This clearly shows the bulk of the teaching workforce is generally composed of those who are middle-aged.

*Sex*

In addition to age, the sex of employees has been a focus of concern for many occupational studies, and the same is true with studies pertaining to the professional longevity of teachers. In some instances, researchers have attempted to control for differences caused by gender (Boyd, Grossman, Ing, Lankford, Loeb, O'Brian, & Wyckoff, 2011). However, oftentimes the gender is studied to see if it has any effect on the professional longevity of a teacher (Beasley, 2013; Boyd, Grossman, Ing, Lankford, Loeb, & Wyckoff, 2011; Ingersoll, 2001; Lasseter, 2012). What is even more intriguing is that gender has shown to be a contributing factor in some studies (Urick, 2012) and not a contributing factor in other studies (Lindqvist, Nordanger, & Carlsson, 2014; Smith & Ingersoll, 2004). With the inconclusiveness of the effects of a teacher's gender on his or her professional longevity, it becomes important to include for consideration that gender, given specific scenarios, could be an influence on a teacher's professional longevity.

*Ethnicity*

An area also under consideration in many educational attrition studies is teachers' ethnicities. Being part of a diversified nation such as the United States means that teachers from various backgrounds and ethnicities have the opportunity to instruct the next generation of Americans. On occasion, a teacher's ethnicity has shown to be a contributing factor in predicting the professional longevity of a teacher, especially for minority teachers (Hancock & Scherff, 2010). However, researchers have also shown that a teacher's ethnicity alone does not influence longevity, but they have found a link between ethnicity and the organizational structure of school (Ingersoll & May, 2011). The key to remember is that several factors appear to contribute to teachers leaving the teaching profession when ethnicity is taken into account. It is not merely the teacher's ethnicity, but rather it is his or her ethnicity combined with the school's demographics, geography, or poverty level, that is important (Scheopner, 2010).

*Salary*

A theme studied often in most occupational studies, especially in education, is a teacher's salary. Although salary has shown to be statistically significant in predicting the migration or attrition of a teacher (Imazeki, 2005), the effect of size is typically small for teachers with several years of experience (Gilpin, 2011). Harris and Adams (2007) further concluded in their study that a 10% increase in a teacher's salary only reduced the likelihood of him or her leaving the profession by 4.7%. If we extrapolate this, it means that a school would have to increase a teacher's salary by 50% in order to come close to a one-in-two chance of being able to keep a teacher in its employ. It is no surprise then, that a teacher's salary is mentioned so often as the reason teachers leave the teaching profession (Borman & Dowling, 2008; Ingersoll, 2001; Ingersoll & Smith, 2003a).

*Degree*

With the desire to hire well-qualified teachers, many studies are now focusing on the degree(s) earned by educators in order to predict whether they will remain in the education system. Researchers have shown that higher degrees do not guarantee more effective teachers (Chingos & Peterson, 2010; Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2013), nor do higher degrees necessarily guarantee that teachers will stay in the profession (Hughes, 2012). Instead, it appears that teachers generally pursue graduate degrees in order to receive higher salaries or to ultimately pursue secondary careers after teaching (Hughes, 2012).

### *School Migration*

The last area of concern I will discuss on the teacher-level is a pseudo-form of teacher attrition—the amount of migration a teacher performs during his or her employment. Although migration is not the same as leaving the education system, as a migrating teacher is merely moving from one school to another, increased migration has been shown to be negatively correlated with the professional longevity of a teacher (Ingersoll, 2001). In other words, the more a teacher moves between schools, the less likely it is that he or she will remain in the education workforce. However, migration has also been tied to student achievement in teacher attrition studies. Because of this connection between teacher migration and student achievement, the full effects of migration on the professional longevity of teachers is still unclear (Ronfeldt, Loeb, & Wyckoff, 2013).

## School-Level Factors in Previous Attrition/Longevity Studies

Another area to consider in this review of literature is factors that potentially influence the professional longevity of a teacher on a school-level. Again, as attrition studies continue to become greater in their complexity, it is important to comprehend how these variables on different levels influence the professional longevity of a teacher. School-level factors include, but are not limited to, variables that a school's administration is either able to control or are set because of the school's geographic location. Such factors include class size, school geography, socioeconomic status (SES), and whether the school is a charter school.

*Class Size*

The size of classes within the public schools has been a topic of great discussion and may be a key in predicting teacher attrition. Over the last 30 years we have seen the number of students increase while the number of teachers has decreased (Ingersoll, Merrill, & Stuckey, 2014). Although class size has been studied as a factor influencing the professional longevity of a teacher (Ingersoll & Merrill, 2010), class size appears to be most often studied in regard to student achievement and classroom management (Staiger & Rockoff, 2010). However, Martin, Sass, and Schmitt (2012) discovered an interesting fact: although classroom size varied little between the elementary and high school grades, high school teachers were more often dissatisfied with their work. This suggests that class size—if studied with respect to student achievement and classroom management—can have an influence on the professional longevity of secondary teachers.

*Geography*

Another area of great discussion within the literature is the geographic location of schools, such as whether the schools are urban or rural, and the school’s inability to keep qualified teachers within the education system. The geographic location of a school is a multifaceted aspect. Teachers (especially newer teachers) have a tendency either to return to schools within their home areas or to go to schools with similar geographic settings (Reininger, 2012). However, depending upon the staffing needs at these schools, they may encounter difficulties obtaining teaching positions. This innate desire to “return home” is further seen by the fact that teachers in unfamiliar geographic locations often either leave or take vacations away from their work locales as much as possible, in order to cope with teaching in unfamiliar locations (Sharplin, O'Neill, & Chapman, 2011). Because teachers prefer specific locales, certain geographic locations become difficult to staff. According to Achinstein, Ogawa, and Sexton (2010), urban schools are often difficult to staff because they often feature conditions that demoralize a teacher's professional longevity. Therefore, certain geographic locations become "hard-to-staff" schools simply because of the student populations they serve.

*Socioeconomic Status*

A theme of concern that is receiving great attention is the socioeconomic status (SES) of a school, and is particularly focused on whether a school offers students free or reduced lunches. The Title I status (percentage of free or reduced lunches offered) of a particular school is often used to represent the SES of a school. Previously conducted research studies show that this method is acceptable for categorizing SES (Rundle, Richards, Bader, Schwartz-Soicher, Lee, Quinn, & Neckerman, 2012). However, other researchers recognize that free or reduced lunch percentage is not the only measure of SES, nor is it necessarily the best measure (Harwell & LeBeau, 2010). However, these arguments are typically used to measure the SES of a student or student group and not to paint a portrait of a school as a whole. This measure of a school's SES has been used to predict the success of schools, student achievement, student workforce potential, and a teacher's professional longevity (Currie & Thomas, 2001; Klassen & Chiu, 2011; Shen, Leslie, Spybrook, & Ma, 2012). Therefore, the practice of using the percentage of free or reduced lunches offered, to categorize the SES of a school, is established and well-documented.

*Charter Status*

Charter schools, which are considered part of the public education system, have also come under scrutiny as being potential contributors of teachers leaving the education system. Although charter schools are more independent than traditional public schools, they have been shown to employ inexperienced teachers and have high attrition rates (Carruthers, 2012; Hoxby, 2002; Malloy & Wohlstetter, 2003). Indeed, Stuit and Smith (2012) determined in their study that charter schools typically have double the turnover rate of their public school counterparts. However, this may be due to the fact that most charter schools typically do not offer any form of tenure for teachers (Preston, Goldring, Berends, & Cannata, 2012). Teachers may feel the necessity to leave their schools due to lack of job security. What is even more intriguing are the findings of Imberman (2011), who concluded that although teachers at charter schools may have less experience, they are typically of higher quality than public school teachers.

## District-Level Factors in Previous Attrition/Longevity Studies

Not only must we review the literature on factors that potentially influence the professional longevity of teachers on the teacher-level and school-level, we must also consider factors from the district-level that may influence these educators. As mentioned earlier, attrition studies continue to grow in their complexity. Therefore, it is incumbent upon us to comprehend how these variables on different levels influence the professional longevity of a teacher. District-level factors include, but are not limited to, variables that a district's administration is either able to control or are set because of their location. These include factors such as a district's socioeconomic status (SES) and its average spending per student.

*Socioeconomic Status*

Although the literature has discussed the influence of a school's SES on a teacher's professional longevity, we must also consider what is stated about a district's average SES. Researchers suggest that the presence of high SES within a school district makes a district prone to staffing difficulties (Adamson & Darling-Hammond, 2012). That is, teachers who serve in schools where there exists a greater SES are more likely to leave these schools. What is unfortunate is that schools with higher SES, and therefore "hard-to-staff," are most often urban school serving minority students (Achinstein et al., 2010; Reininger, 2012). The presence of these high SES schools means that districts will have high SES values, and entire districts then become "hard-to-staff."

*Student Spending*

Not only must a district's average SES be explored, another factor that needs reviewing is what the literature shows concerning the effects of a district's average spending per student in predicting a teacher's professional longevity. According to the literature, student spending seems to be correlated with SES. The higher the SES of a district the less "visible" (unallocated) funding the district receives and the more "hidden" (allocated) funding it receives through Title I (Jimenez-Castellanos, 2010). What is alarming to teachers is that if a district reports high levels of spending per pupil, teachers often wonder where the available funds are. Unfortunately, these funds have a tendency to already be allocated and not available for teacher use (Jimenez-Castellanos, 2010). What is even more startling is that when a teacher leaves, the school has to spend a portion of its funding to fill the teacher's vacancy. This means that schools and districts which have high SES typically spend large portions of their available funding on filling vacancies rather than on their students (Watlington, Shockley, Guglielmino, & Felsher, 2010).

## Current State of Science Education

The purpose of the previous review of the literature on these various topics is to prepare and provide a backdrop for the discussion of the current state of science education in the public school system. Although other subject areas of education also suffer the effects of teacher attrition and lack of professional longevity, science education is the chosen focus of this study. In the remaining paragraphs of this literature review, I will look at the current attrition and professional longevity of science educators, how professional scientists are career-changing and becoming teachers, explore whether science teacher attrition is on the rise, and conclude by questioning whether former professional scientists are leaving the public education arena faster than trained professional science educators. This is done in an effort to help determine whether science teacher attrition is mostly comprised of scientist career-changers or those initially trained to be science educators.

### *Science Teacher Attrition*

Ingersoll has studied teacher attrition for decades and has successfully shown trends in teacher attrition throughout the course of his study. It is amazing to see that science teacher attrition is the highest of all subject areas (Ingersoll & Perda, 2010). Through his research, Ingersoll showed that teachers leave for various reasons. These reasons include salary, time, and stressful conditions. However, what Ingersoll does not address is whether the science teachers leaving the school system are career changers or initial-trained science educators. Regardless, either voluntarily or through sweeping legislation, it is obvious that science teacher education needs reform in order to attract, recruit, and effectively train science teachers who will stay in science education (Proweller & Mitchener, 2004).

*Second-Career Teachers*

Ingersoll and Merrill (2011) stated that in order to fill staffing needs, public schools now rely on new arenas for recruiting faculty to teach in their institutions. Once a career reserved for those who had been properly trained, teaching is now a career that any person, who has a desire to teach, can enter (Ingersoll & Kralik, 2004). Typically, as long as a person satisfies certain experience requirements and agrees to follow a specific training regiment, he or she is permitted to teach in the public school system. Thus the public school system now seems to have a never-ending population of potential teachers. Drawing from every possible career, schools can recruit and train individuals who want to influence the next generation (Jeanpierre, 2007). In education, several research studies define these individuals as second-career teachers or career-switchers (Boyd, Grossman, Ing, Lankford, Loeb, O'Brian et al., 2011; Mayotte, 2003; Tigchelaar, Vermunt, & Brouwer, 2012). It is therefore simple to conclude that, on the surface, teacher shortages should be a thing of the past with this new arena of recruits.

*Definition of Second-Career Teachers*. In order to fully understand what is entailed in becoming a second-career teacher or career switcher, it is important to know how researchers define this term. When reading Tigchelaar, Brouwer, and Korthagen (2008), the definition would be any person who alters his or her livelihood after being in a particular field of study or line of work for a significant period. However, there seems to be some dispute as to how much a person needs to change his or her career in order to be classified as a career-changer. For example, some researchers say a person must wholly leave the former occupation and fully embrace the newfound career (Proweller & Mitchener, 2004).

*Scientists becoming Science Teachers*. The occupational switch I will discuss is the career changing of scientists (anyone who has an occupation in science, technology, or engineering) to science teachers. The types of professional scientist vary in each instance of career-changing. These scientists were at one time lab technicians, researchers, or medical personnel (Grier & Johnston, 2009). Regardless of their career background, they are knowledgeable of scientific principles and desire to become science teachers within the school system. According to Kahle and Kronebusch (2003), the current state of science teacher education is a “fractured system” (p. 585). Furthermore, science education in the United States is in desperate need of reform (van Driel et al., 2001). Therefore, it easy to understand at least one reason why scientists switch careers; they wish to reform science education with the intention of improving what they believe is a flawed system. However, as Ballone-Duran, Czerniak, and Haney (2005) state, these scientists soon realize that the complex battle to reform science education is one that will take commitment and time to accomplish. It can be assumed, then, by pulling in professional scientists as teachers, schools might well be able to offer more specialized science courses.

Of the career-changers who enter science education, what careers are most represented? The majority of career-changers who go into science education are either professional research scientists or worked in a scientific laboratory before switching to teaching (Chambers, 2002; Greenwood, 2003; Ingersoll & Perda, 2010). It is not surprising that professional scientists are the major career-changers who switch to teaching science. With their prior background, professional scientists have the content knowledge necessary to switch to careers in education.

*Attempting to Bridge the Pedagogical Gap*. Although professional scientists have the content knowledge to be science teachers, they typically lack the ability to teach due to their absence of pedagogical training. According to van Driel et al. (2001), not only do the experiences of a career-changer typically not transfer into the teaching profession, career-changers also lack overall pedagogical knowledge. I must be clear, however, that this does not mean that career-changers have no content knowledge concerning their subjects. On the contrary, Greenwood (2003) stated that career-changers are very often knowledgeable about the content of their subjects. However, they usually lack overall knowledge about how to effectively teach (Eifler & Potthoff, 1998; Tigchelaar, Brouwer, & Korthagen, 2008). Skinner (1954) noted that teaching is an art, not a science. In many ways this is true. It can be inferred, then, that if teaching was a science, anybody could memorize a process and effectively teach students. Many career-changers hold a variety of viewpoints when it comes to the art of teaching. Some say teaching is simply the conveyance of facts at the teacher’s discretion, others say students should experience direct learning, and some career-changers say teaching must be a sort of intuitive reflection upon knowledge (Tigchelaar et al., 2012).

Williams (2010) reported that what is even more alarming is that many career changers do not wish to learn more because they feel that their own experience is sufficient for them to effectively teach. In order to help combat these situations, school systems have developed various training initiatives in order for career-changers to further develop their teaching techniques and pedagogical knowledge (Tigchelaar, Brouwer, & Vermunt, 2010). Several school districts now require new teachers, regardless of previous career background, to be mentored by experienced teachers. According to Cohen-Vogel and Smith (2007), school districts may instead require a new teacher, especially a career-changer, to enroll in an alternative certification program (ACP) in order to be qualified to teach in the new teacher's respective area. This particular route has become the method of choice for many school districts since the number of available recruits is so low (Mewborn, 2001). The question that remains, however, is whether these ACPs are adequately preparing new, incoming teachers.

*Trends in Science Teacher Attrition*

As seen in recent research, science teacher attrition continues to rise each academic year. In another study conducted by Ingersoll and Perda (2010), the authors stated that science teacher attrition shows no signs of slowing or being reversed. Additionally, science teacher attrition rates are the highest of all subject areas (on average 56% of public schools are in need of science teachers), and the demand for qualified science teachers is also the highest (Ingersoll & Perda, 2010).

Many public schools in the United States advertise for science teachers each academic year. Additionally, there is a need for science teachers throughout the school year. Therefore, science teachers are always in demand at public schools in the United States.

Murnane, Singer, Willett, Kemple, and Olsen (1991) determined that the first years are those with the greatest potential for new teachers to leave education. Moreover, attrition among science educators is very high compared to those teaching other subjects

(Murnane et al., 1991). The question that remains is, of the teachers who are leaving science education, are they career-changers or initially-trained science educators?

## Interpretative Summary

It is now important to synthesize and summarize the literature reviewed in this chapter. First, teacher attrition is a complex issue to study because of the multifaceted approaches available to researchers and the plethora of variables, which may or may not contribute to a teacher leaving the profession (Grayson & Alvarez, 2008; Schaefer et al., 2012; Staiger & Rockoff, 2010; Ware & Kitsantas, 2011). Second, studies exist in which researchers contradict other researchers' findings as to whether variables are statistically significant factors in influencing the professional longevity of teachers (DeAngelis & Presley, 2011; Hancock & Scherff, 2010; Ingersoll & May, 2011; Lindqvist et al., 2014; Smith & Ingersoll, 2004; Urick, 2012). Third, teacher attrition continues to rise with very few policies being enacted to help stem its tide (Darling-Hammond, 2010; Ingersoll & May, 2011; Ingersoll et al., 2014). Finally, many studies do not address the hierarchical nature of factors within levels of education (Carruthers, 2012; DeAngelis & Presley, 2011; Ingersoll, 2012; Skaalvik & Skaalvik, 2011; Stuit & Smith, 2012).

### *Gap in the Literature*

Of all the research that has been conducted, there has not been a study that attempts to predict the professional longevity of high school science teachers using factors on multiple levels within an entire state. Statewide studies have been conducted (Kardos & Johnson, 2010). However, I cannot find in the literature a study conducted pertaining to the professional longevity of teachers by analyzing multiple factors on different levels of education. Second, I cannot find in the literature a hierarchical study pertaining to the professional longevity of high school science teachers. It is true that researchers have conducted multiple, one-level studies on factors that influence a science teacher's professional longevity (Ingersoll, 2001; Ingersoll & May, 2011; Ingersoll & Merrill, 2010; Ingersoll & Perda, 2010). However, I cannot find in the literature a study that analyzes factors on different levels of education for science teachers. Finally, I have found no studies in the literature that which used archival data from a state's Department of Education. Of the reviewed studies, all analyzed data were published by NCES or the SASS (Boyd, Grossman, Ing, Lankford, Loeb et al., 2011; Gilpin, 2011; Ingersoll & May, 2011; Ingersoll et al., 2014; Scheopner, 2010).

*How Study Adds to the Current State of Knowledge*

This study will add to the current state of the literature by analyzing various factors, on hierarchical levels, that may influence the professional longevity of science teachers within the state of Florida. Hopefully this study will provide further insight into how these factors influence (positively or negatively) the professional longevity of high school science teachers across the entire state of Florida. By successfully identifying what factors, across a three-level hierarchy, can predict the professional longevity of high school science teachers, we will gain a better understanding of how to combat teacher attrition, in an effort to retain high-quality science educators.

# CHAPTER III - METHODOLOGY

## Overview and Restatement of Purpose

This study is a quantitative analysis of factors related to the professional longevity of high school science teachers within the public school system in the state of Florida. This study utilizes exploratory multiple linear regressions (MLR) in order to statistically test various independent variables on different levels of education (teacher, school, and district). Once statistically significant factors were determined by exploratory analysis, a hierarchical multiple regression (HMR), was utilized to determine a final statistical model. Science teacher professional longevity was assessed by analyzing data gathered by the National Center for Education Statistics (NCES), the National Assessment of Educational Progress (NAEP), and the Florida Department of Education (FLDOE) for all high school (9–12 grade) science teachers, during the 2011–2012 to 2013–2014 academic years. The purpose of this study is to determine what factors influence the professional longevity of high school science teachers in Florida.

## Research Objectives

In order to effectively fulfill the purpose of this study, it is important to state its overarching research objectives. These research objectives guided the methodology of this study and are aligned with the research hypotheses mentioned in Chapter I. The research objectives for this study are as follows:

1. To determine the statistical relationship of selected teacher-level independent variables on the professional longevity of high school science teachers in the state of Florida.

2. To determine the statistical relationship of selected school-level independent variables on the professional longevity of high school science teachers in the state of Florida.
3. To determine the statistical relationship of selected district-level independent variables on the professional longevity of high school science teachers in the state of Florida.
4. To determine the statistical relationship of statistically significant variables (from previous analyses) on the professional longevity of high school science teachers in the state of Florida when tested in a HMR.

## Statistical Testing and Analysis

Whenever running statistical tests on data within the realm of education, successful statistical testing and analysis can become complicated (Schaefer et al., 2012). The reason for this is that variables in education are not typically on the same level. For example, within this study, I will be analyzing data from three different levels: the teacher, school, and school district. Because of the nature of education and HMR, variables found on higher levels of statistical testing can influence the predictive outcome of variables on lower levels (Field, 2009). Therefore, I utilize two types of statistical tests in order to evaluate my research hypotheses. I utilized an exploratory multiple linear regression (MLR) and a hierarchical multiple regression (HMR) in order to evaluate my research objectives.

### *Exploratory Multiple Linear Regression*

Multiple linear regressions (MLR) are utilized in order to test the statistical significance of independent variables from different levels of the collected data. Three levels were created due to the nature of the data. I gathered data that pertained to teachers, schools, and school districts. Since three levels were created, three statistical models were developed in order to determine the influence of the independent variables on the dependent variable. According to Field (2009), since these variables are from different "levels" of education, it would not be appropriate to place all of the independent variables into a single MLR. Therefore, each level, along with its corresponding independent variables, had to be analyzed separately and three different statistical models needed to be created.

An exploratory approach was used to determine what independent variables on each level were statistically significant and how much they predicted the outcome of the dependent variable. This method was necessary due to additional variables added by the FLDOE to my study. According to Field (2009), if there is little support to justify the inclusion of variables, an exploratory method should be adopted. Since, in many instances, there is little to no literature to support the inclusion of the additional variables recommended by FLDOE, it became imperative to adopt an exploratory approach. For any variable that is ultimately removed from the final statistical model for its level, a correlation test was conducted to determine how the removed variables correlate with the dependent variable.

*Hierarchical Multiple Regression*

Once the three statistical models were developed from the exploratory analyses, all statistically significant variables were included in a HMR. A HMR statistical test allows one to create different levels within the HMR in order to test the different independent variables from each level and show how higher-level variables affect lower-level variables. A three-level HMR is created using the statistically significant independent variables from the previous exploratory MLRs. The use of an HMR in this type of study is important due to the fact that independent variables on higher levels of the HMR can affect the predictive capacity of independent variables on lower levels (Field, 2009).

## Data Collection

Data collected by the NCES, NAEP, and FLDOE for three academic years (2011–2012 to 2013–2014) was used to conduct this study. Specifically, these were data pertaining to each high school science teacher in the state of Florida school system. Variables from three different levels within the Florida educational system were used. These levels include data pertaining to teachers, schools, and school districts.

### *Defining the Population*

In order to fulfill the purpose of this study, the population analyzed was the group of high school science teachers who left the Florida school system during the 2011–2012 to 2013–2014 academic years. It was necessary to study this population in order to determine what independent variables influenced their leaving the Florida school system. In order for the MLR and HMR analyses to be successful, it was important to study a large population (Field, 2009). I estimate that with several thousand teachers leaving the Florida school system each year (Florida Department of Education, 2013); the final data set will be adequately large to perform the various statistical analyses.

### *Data Sources*

Data were collected from three archival repositories of educational data: NCES, NAEP, and the FLDOE. Collecting data from NCES and NAEP is rather simple, since data from these two federal agencies is readily available for dissemination from their respective websites within the U.S. Department of Education (USDE). However, in order to collect data from the state of Florida, I was required to submit an application to conduct research with data archived in Florida's Education Data Warehouse (EDW). This process was rather lengthy; however, I was able to receive the data I needed to conduct my study. In addition to receiving the data I requested, FLDOE suggested that I add into my study additional independent variables they wished to have analyzed. The addition of these variables forced a change in my originally intended hierarchical linear modeling methodology, which was easily remedied. (Refer to Appendix B to see the initial research application.)

*Data Collection Timeline*

The following timeline outlines preliminary steps I followed in conducting this study. I received approval from The University of Southern Mississippi's (USM) Institutional Review Board (IRB) to conduct my study during the spring semester of 2015. I submitted a request to access Florida's EDW during the same semester and began receiving the data approximately seven months later, during the fall 2015 semester. I continued to receive data from FLDOE until June 2016. From the beginning of receiving the data as text files from the FLDOE, I cleaned the data and laid it out in an appropriate form within Microsoft Excel. Once the Excel data set was completed, the data set was imported into IBM's SPSS for analysis. Although a lengthy process was required in order to achieve a final data set, the final result produced a reliable data set that could be easily analyzed using SPSS. A summary of the data collection timeline is found in Table 3.

Table 3

*Summary of Data Collection Timeline*

| Semester and Data Collection Steps |
|---|
| Spring 2015 |
| Obtained IRB approval from USM |
| Submitted research proposal to access FLDOE's EDW |
| Summer 2015 |
| Gathered data from NCES and NAEP |
| Cleaned and prepared NCES and NAEP data for analysis |
| Fall 2015 |
| Began receiving data from FLDOE |
| Began cleaning data from FLDOE |
| Spring 2016 |
| Received final data from FLDOE |
| Final cleaning of FLDOE data |
| Summer 2016 |
| Finalized data set in Excel |
| Imported data set into SPSS and began analysis |

*Data Variables*

The dependent variable of this study is the professional longevity of a teacher in the Florida school system. This variable is measured in years and represents the number of completed years of teaching within the Florida school system. The greater the completed years of service, the greater the professional longevity a teacher achieved with the Florida school system.

There were 38 independent variables analyzed in this study. Although this is a large number of variables, many of those variables are categorical variables created from "dummy" coding variables found within larger generalized variables (e.g., ethnicity, earned degree, geographic location, and residential population density). The analyzed independent variables are as follows: (Level 1) a teacher's sex, age, salary, ethnicity (six sub-variables), earned degree (seven sub-variables), number of places taught during the last year of employment, migration count, Florida public years of teaching, Florida non-public years of teaching, out-of-state public years of teaching, out-of-state non-public years of teaching, years of military service, years of serving in school administration, years teaching within their current district, years teaching within their current assignment, and total years of teaching (in and outside of Florida). For the school level independent variables, the following data were analyzed: (Level 2) average class size, charter status, socioeconomic status (SES), geographic location (three sub-variables), and residential population density (two sub-variables). For the district level independent variables, the following data were analyzed: (Level 3) average SES and average spending per 9–12 grade student.

## Data Cleaning and Preparation

In order to effectively analyze the collected data, careful steps had to be developed in order to successfully and accurately clean the data. Data files were gathered from NCES, NAEP, and FLDOE in the form of text or Excel files. Each text file was then imported into Microsoft Excel using the “Import” function. The “Text File” import option was selected and the imported file was denoted as being tab delimited. This resulted in the successful import and conversion of each text file to an Excel file. The appropriate data from each Excel file were merged into a single Excel file in order to assemble the data set. The cleaned data set was then imported into SPSS for analysis. Refer to Appendix C for more detailed descriptions of how the data was cleaned in order to glean specific data elements.

## Data Analysis Process

In order to properly analyze the final data set, SPSS was used to conduct the MLR and HMR statistical testing for this study. The final data set imported into SPSS contains 52 columns. Many of these columns are simply descriptive statistics that transferred over so that I would not have to program into SPSS 577 different high schools and 70 school district names.

### *Multiple Linear Regression Procedures*

In order to conduct a MLR for each of the different levels of data, I followed this pathway within SPSS to bring up the linear regression display: Analyze to Regression to Linear. Once in the linear regression display, the “Professional Longevity” variable was placed in the dependent slot and all the appropriate independent variables for a single level were placed in the independent(s) box. Under the “Statistics” option, I selected to have estimates, confidence intervals, model fit, R squared change, descriptive statistics, collinearity diagnostics, Durbin-Watson, and casewise diagnostics outside 3 standard deviations produced. Under the “Plots” option, I chose to graph ZRESID vs. ZPRED and produced a histogram and normal probability plot. Under the “Save” option, I selected to save the unstandardized predicated values and the unstandardized residuals. After all this, I selected “OK” and SPSS conducted the MLR analysis. The SPSS outputs are discussed in Chapter IV. This method is conducted for each level (teacher, school, and district) for the MLR analyses. Once the statistically significant variables were determined for each level, these variables were carried over into the HMR analysis. When a final model was determined, eight tests of assumptions for multiple regressions were conducted (Field, 2009).

*Hierarchical Multiple Regression Procedures*

The procedure to successfully conduct a HMR is very similar to conducting the MLR previously mentioned. However, one additional step is needed in order to conduct the HMR. After bringing up the linear regression display, I needed to enter the statistically significant independent variables from the previous MLR models into "Blocks" within the statistical model. Within Block 1, I entered all the statistically significant variables from the teacher-level MLR (Model 1.6). In Block 2, I entered all the statistically significant variables from the school-level MLR (Model 2.1). Within Block 3, I entered all the statistically significant variables from the district-level MLR (Model 3.1). All other options were kept the same, as mentioned in the testing for each MLR. The SPSS output is discussed in Chapter IV. When a final model was determined, eight tests of assumptions for multiple regressions were conducted (Field, 2009).

*Tests of Assumptions*

In order to determine if a MLR or HMR statistical model is unbiased and generalizable, I had to test to see if the assumptions of MLR and HMR were met. If those assumptions were not met, then the statistical model could be biased and not generalizable to other populations. Field (2009) listed the following eight tests of assumptions that I adhered to in my study:

1. Variable types: All predictor variables must either be continuous or categorical.
2. Non-zero variance: All predictors should exhibit variance.
3. No multicollinearity: There should be no correlations ($r > .80$) between predictor variables or with the dependent variable.

4. Homoscedasticity: The residuals at each level should have the same variance.
5. Independent errors: Residuals should be uncorrelated.
6. Normally distributed errors: The residuals should exhibit a mean of zero.
7. Independence: Each outcome variable is from a separate entry.
8. Linearity: The mean value for an increment of a predictor lies along a straight line.

If these assumptions are not met, the generalizability of the study is called into question. However, valid conclusions can still be made from the population found within the data set (Field, 2009).

## Form of the Results

After the analyses, the results came mostly in the form of tables and figures. Specifically, I created tables that contained the various model summaries of each generated model as well as tables of unstandardized *B*, standard errors of *B*, beta ($\beta$) values, *t*-scores, and significance. I also produced tables of descriptive statistics of the final data set. With regard to the figures, I created a map of Florida, separated by school district, that shows how many science teachers and what percentage of science teachers left the Florida school system during the studied period. Other figures include plots containing histograms in order to visually determine the distribution of data values, normal P–P plots to determine the linearity of a statistical model, and scatterplots of ZRESID vs. ZPRED to determine the presence of heteroscedasticity.

# CHAPTER IV – RESULTS

## Restatement of Purpose

The purpose of this study is to determine what factors influence the professional longevity of high school science teachers in Florida. In order to decide which factors influence the professional longevity of Floridian high school science teachers, it was necessary to conduct several multiple linear regression statistical analyses. The dependent variable "Professional Longevity" was tested with various independent variables on three levels: Level 1 (teacher variables), Level 2 (school variable), and Level 3 (district variables). The following chapter will report the results from the statistical analyses, correlations, tests for assumptions, and descriptive statistics of the final data set.

## Data Descriptives

After cleaning the data received from the Florida Department of Education (FLDOE), data from a total of 2,003 high school science teachers remained within the final data set. These teachers represent a population of high school science teachers who left the Florida school system during the 2011–2012 to 2013–2014 academic school years. The following paragraphs report the data descriptive statistics for the dependent variable and for the independent variables on each level of the analyses.

### *Dependent Variable Descriptives*

The dependent variable (Professional Longevity) in this study is the years of service a teacher completes within the state of Florida. Of 2,003 teachers found within the data set, the average length of service was 8.42 years. The longest serving teacher worked 47 years and 437 teachers served less than a year. Within the first five years of teaching, 52.2% of the sciences teachers in the data set left the Florida teaching workforce. From this group, 437 left within their first year, 206 left after one year of service, 132 left after two years, 86 after three years, 83 after four years, and 101 after five years. In total, 1,045 science teachers (52.2%) left the teaching profession within the first five years of service. Additionally, 43.0% of the teachers within the data set left the Florida school system within the first three years of teaching. The frequency distribution of the dependent variable is summarized in Table 4.

Table 4

*Frequency Distribution of Professional Longevity (DV)*

| DV | *f* | % Pop. | Cum. % | DV | *f* | % Pop. | Cum. % |
|---|---|---|---|---|---|---|---|
| 0 | 437 | 21.8 | 21.8 | 23 | 18 | 0.9 | 88.6 |
| 1 | 206 | 10.3 | 32.1 | 24 | 11 | 0.5 | 89.2 |
| 2 | 132 | 6.6 | 38.7 | 25 | 23 | 1.1 | 90.3 |
| 3 | 86 | 4.3 | 43.0 | 26 | 17 | 0.8 | 91.2 |
| 4 | 83 | 4.1 | 47.1 | 27 | 20 | 1.0 | 92.2 |
| 5 | 101 | 5.0 | 52.2 | 28 | 17 | 0.8 | 93.0 |
| 6 | 112 | 5.6 | 57.8 | 29 | 17 | 0.8 | 93.9 |
| 7 | 96 | 4.8 | 62.6 | 30 | 11 | 0.5 | 94.4 |
| 8 | 72 | 3.6 | 66.2 | 31 | 20 | 1.0 | 95.4 |
| 9 | 55 | 2.7 | 68.9 | 32 | 15 | 0.7 | 96.2 |
| 10 | 65 | 3.2 | 72.1 | 33 | 12 | 0.6 | 96.8 |
| 11 | 45 | 2.2 | 74.4 | 34 | 24 | 1.2 | 98.0 |
| 12 | 38 | 1.9 | 76.3 | 35 | 12 | 0.6 | 98.6 |
| 13 | 31 | 1.5 | 77.8 | 36 | 6 | 0.3 | 98.9 |
| 14 | 26 | 1.3 | 79.1 | 37 | 6 | 0.3 | 99.2 |
| 15 | 26 | 1.3 | 80.4 | 38 | 4 | 0.2 | 99.4 |
| 16 | 23 | 1.1 | 81.6 | 39 | 6 | 0.3 | 99.7 |
| 17 | 23 | 1.1 | 82.7 | 40 | 3 | 0.1 | 99.8 |
| 18 | 26 | 1.3 | 84.0 | 41 | 1 | 0.0 | 99.9 |
| 19 | 19 | 0.9 | 85.0 | 42 | 1 | 0.0 | 99.9 |
| 20 | 22 | 1.1 | 86.1 | 43 | 1 | 0.0 | 100.0 |
| 21 | 14 | 0.7 | 86.8 | 47 | 1 | 0.0 | 100.0 |
| 22 | 19 | 0.9 | 87.7 | | | | |
| | | | | Total | 2003 | 100.0 | 100.0 |

*Teacher Level Descriptives*

Of the 2,003 high school science teachers, nearly two-thirds are female. Over 70% of the teachers are White and about half the remaining teachers are Black. The most frequent ($f$ = 1,287) highest degree earned by these science teachers is a baccalaureate. The average age of the science teacher population is 44. The mean salary of this data set of high school science teachers is $31,021. These and other teacher level descriptive statistics are summarized in Table 5.

Table 5

*Teacher Level Descriptive Statistics*

| Characteristic | $f$ | $\bar{X}$ | % Pop. |
|---|---|---|---|
| Sex | | | |
| Female | 1,258 | | 62.8 |
| Male | 745 | | 37.2 |
| Age[a] | | 44 | |
| Ethnicity | | | |
| Asian | 63 | | 3.1 |
| Black | 262 | | 13.1 |
| Hispanic | 180 | | 9.0 |
| American Indian/Alaska Native | 12 | | 0.6 |
| Native Hawaiian/ Pacific Islander | 3 | | 0.2 |
| White | 1,452 | | 72.5 |
| Multiracial | 31 | | 1.5 |
| Degree | | | |
| High School | 1 | | 0.1 |
| Vocational/Technical | 1 | | 0.1 |
| Associates | 29 | | 1.4 |
| Baccalaureate | 1,287 | | 64.3 |
| Masters | 537 | | 26.8 |
| Specialists/Advanced Masters | 18 | | 1.0 |
| Doctorate | 71 | | 3.5 |
| Unknown/Not Reported | 59 | | 2.9 |
| Migration | | | |
| None | 1,888 | | 94.3 |
| Once | 113 | | 5.6 |
| Twice | 2 | | 0.1 |

Table 5 (continued).

| | | |
|---|---|---|
| No. Schools | | |
| One | 1,975 | 98.6 |
| Two | 28 | 1.4 |
| Salary[b] | 31,021 | |

[a]Measured in years. [b]Measured in U.S. dollars.

*School Level Descriptives*

The 2,003 teachers in the data set represent 577 high schools from the school system of the state of Florida. Most of the science teachers worked at schools in the suburbs (*f* = 967). Within these locations with respect to residential population density, 1,249 teachers worked in large/fringe schools and 1,827 teachers taught in traditional public schools. The mean 9–12 grade class size at these high schools is 15 students. These values and other school level variables are summarized in Table 6.

Table 6

*School Level Descriptive Statistics*

| Characteristic | *f* | $\bar{X}$ | % Pop. |
|---|---|---|---|
| No. High Schools | 577 | | |
| School Region | | | |
| City | 586 | | 29.3 |
| Suburb | 967 | | 48.3 |
| Town | 114 | | 5.7 |
| Rural | 336 | | 16.7 |
| Population Density | | | |
| Large/Fringe | 1,249 | | 62.4 |
| Midsize/Distant | 487 | | 24.3 |
| Small/Remote | 267 | | 13.3 |
| Charter Status | | | |
| Public | 1,827 | | 91.2 |
| Charter | 176 | | 8.8 |
| Class Size (9–12)[a] | | 15 | |
| SES[b] | | 49 | |

[a]Measured in number of students. [b]Measured in percentage of free/reduced lunch offered to students in 9–12 grade.

*District Level Descriptives*

There are 70 school districts represented by the 2,003 teachers remaining in the final data set. The average SES for the school districts is 57%. The average district spending per student in 9–12 grades is $7,189. What is also fascinating to observe is the frequency distribution of the number of teachers who quit during the studied period (Figure 1), whereas Figure 2 shows the percentage range of the population of high school science teachers who quit during the studied period. Looking at Figure 1, the school districts, which experienced the greatest number of science teachers leaving, were: Broward, Duval, Orange, and Palm Beach districts. However, when you compare this to

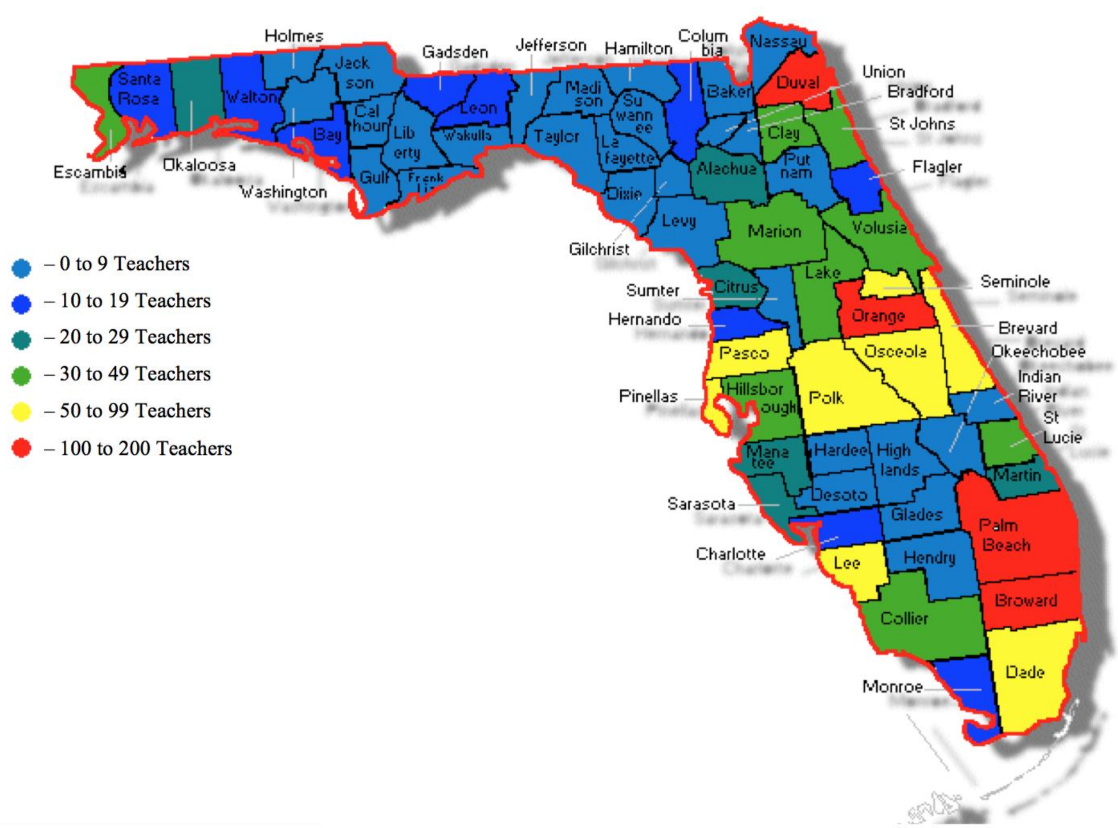


*Figure 1.* Frequency distribution of teachers who quit.

Note. This figure represents the number of science teachers who quit the Florida school system in each school district from 2011–2012 to 2013–2014. Figures were produced at www.diymaps.net.

the percentage of the population of science teachers who left during the studied period in Figure 2, the Franklin and Taylor school districts had the highest percentage of science teachers leave the Florida school system. A more detailed summary of the data displayed in Figures 1 and 2 is found in Table 7.

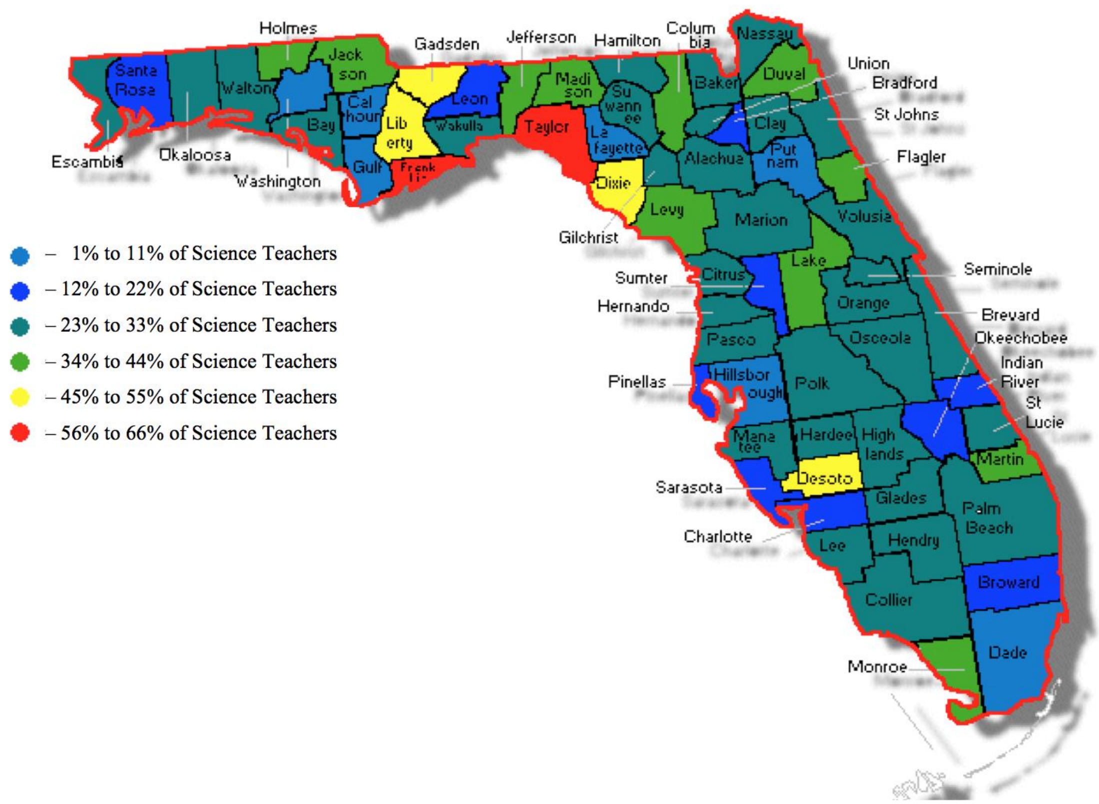


*Figure 2.* Frequency distribution of percentage of teachers who quit.

Note. This figure represents the percentage of science teachers who quit the Florida school system in each school district from 2011–2012 to 2013–2014. Figures produced at www.diymaps.net.

## Level 1 – Teacher Variable MLR Results

Level 1 of this study required several rounds of statistical testing in order to determine which independent variables the model supported. In the end, a total of six rounds of testing were needed in order to achieve a model that appeared to be an accurate predictor of a science teacher's professional longevity. For reference, the full, detailed

Table 7

*Science Teachers Leaving by School District from 2011–2014*

| School District | No. Teachers Quit | % Teachers Quit | School District | No. Teachers Quit | % Teachers Quit |
|---|---|---|---|---|---|
| Alachua | 25 | 31 | Lake | 45 | 34 |
| Baker | 4 | 26 | Lee | 58 | 25 |
| Bay | 19 | 25 | Leon | 15 | 16 |
| Bradford | 6 | 17 | Levy | 8 | 44 |
| Brevard | 82 | 33 | Liberty | 3 | 50 |
| Broward | 200 | 22 | Madison | 3 | 42 |
| Calhoun | 2 | 11 | Manatee | 25 | 23 |
| Charlotte | 15 | 21 | Marion | 35 | 30 |
| Citrus | 22 | 28 | Martin | 20 | 38 |
| Clay | 33 | 26 | Monroe | 12 | 40 |
| Collier | 34 | 25 | Nassau | 9 | 29 |
| Columbia | 10 | 40 | Okaloosa | 23 | 25 |
| Dade | 86 | 11 | Okeechobee | 3 | 16 |
| Desoto | 9 | 47 | Orange | 168 | 31 |
| Dixie | 4 | 50 | Osceola | 52 | 32 |
| Duval | 128 | 34 | Palm Beach | 142 | 23 |
| Escambia | 36 | 33 | Pasco | 54 | 24 |
| Flagler | 12 | 34 | Pinellas | 51 | 18 |
| Franklin | 2 | 66 | Polk | 73 | 25 |
| Gadsden | 12 | 54 | Putnam | 2 | 11 |
| Gilchrist | 2 | 28 | Santa Rosa | 14 | 22 |
| Glades | 1 | 33 | Sarasota | 23 | 17 |
| Gulf | 1 | 11 | Seminole | 58 | 25 |
| Hamilton | 1 | 25 | St. Johns | 32 | 32 |
| Hardee | 4 | 30 | St. Lucie | 35 | 32 |
| Hendry | 5 | 29 | Sumter | 6 | 20 |
| Hernando | 17 | 23 | Suwannee | 8 | 33 |
| Highlands | 8 | 28 | Taylor | 6 | 66 |
| Hillsborough | 43 | 7 | Union | 2 | 25 |
| Holmes | 3 | 37 | Volusia | 49 | 28 |
| Indian River | 7 | 14 | Wakulla | 3 | 27 |
| Jackson | 7 | 36 | Walton | 11 | 31 |
| Jefferson | 2 | 40 | Washington | 2 | 9 |

Note. The following districts (and number of teachers) are not included in these figures and table because they are considered "specialized" districts by FLDOE: FAMU Lab School (1), Florida Virtual (105), FSU Lab School (3), and UF Lab (2).

analysis of this process, variable coding, and results from tests of assumptions is included in Appendix D. The following paragraphs report the results of the final Level 1 model.

*Model 1.6 Results*

Model 1.6 represents the final model for the Level 1 (teacher) analysis. For Model 1.6, a multiple linear regression was conducted to predict the years of service a high school science teacher will serve in Florida based upon the remaining 16 independent variables (see Appendix D for results from Model 1.1 to Model 1.5). A significant regression equation was computed ($F(16, 1986) = 96.487$, $p < .001$), with an $R^2$ of .433. The model summary and *B* coefficients for Model 1.6 are summarized in Table 8 and Table 9 respectively. A science teacher's professional longevity is equal to – 11.54 + .42 (Age) – .33 (Sex) + 7.80 E–5 (Salary) – 4.41 (Baccalaureate vs. Unknown) + 14.50 (Baccalaureate vs. Secondary) + 7.43 (Baccalaureate vs. Vocational) – 5.70 (Baccalaureate vs. Associate) + .18 (Baccalaureate vs. Masters) + 2.91 (Baccalaureate vs. Specialist) – 3.71 (Baccalaureate vs. Doctorate) – 2.20 (White vs. Asian) – 1.03 (White vs. Black) – 2.22 (White vs. Hispanic) – 3.99 (White vs. American Indian/Alaska Native) – .24 (White vs. Multiracial) – 16.55 (White vs. Native Hawaiian/Pacific Islander).

Table 8

*Model Summary of Level 1 Teacher Independent Variables*

| Model[a] | *R* | $R^2$ | *SEE* | *F* | $df_1$ | $df_2$ | *Sig.* | *Durbin-Watson* |
|---|---|---|---|---|---|---|---|---|
| 1 | .661[b] | .437 | 7.412 | 96.487 | 16 | 1986 | .000 | 2.003 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools). [b]Predictors: Age, Sex, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Secondary, Baccalaureate vs. Vocational, Baccalaureate vs. Associate, Baccalaureate vs. Masters, Baccalaureate vs. Specialist, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. American Indian/Alaska Native, White vs. Multiracial, White vs. Native Hawaiian/Pacific Islander.

Table 9

*Coefficients for Model 1.6*

| Independent Variable[a] | *B* | *Sig.* |
|---|---|---|
| Constant | –11.54 | <.001 |
| Age | 0.42 | <.001 |
| Sex | –0.33 | .342 |
| Salary | 7.80 E–5 | <.001 |
| Earned Degree | | |
| Baccalaureate vs. Unknown | –4.41 | <.001 |
| Baccalaureate vs. Secondary | 14.50 | .111 |
| Baccalaureate vs. Vocational | 7.43 | .318 |
| Baccalaureate vs. Associate | –5.70 | <.001 |
| Baccalaureate vs. Masters | 0.18 | .646 |
| Baccalaureate vs. Specialist | 2.91 | .099 |
| Baccalaureate vs. Doctorate | –3.71 | <.001 |
| Ethnicity | | |
| White vs. Asian | –2.20 | .022 |
| White vs. Black | –1.03 | .041 |
| White vs. Hispanic | –2.22 | <.001 |
| White vs. American Indian/Alaska | –3.99 | .064 |
| White vs. Multiracial | –0.24 | .858 |
| White vs. Native Hawaiian/Pacific Islander | –16.55 | .002 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

*Model 1.6 Estimated Parameters*

According to the SPSS output, a teacher's predicted years of service increased 0.42 years for every year a teacher aged when all other factors are held constant. When comparing a teacher's sex, a male teacher's years of service are predicted to be 0.33 years lower than a female teacher's years of service when all other factors are held constant. In looking at a teacher's salary, the years of service increase by 0.0000780 years for every dollar increase in salary when all other factors are held constant.

In looking at the earned degree of a teacher, all degrees are compared to a baccalaureate degree because it is the most occurring degree. If a teacher did not report his or her degree (Unknown), the predicted years of service were 4.41 years—less than a teacher with a baccalaureate degree. If the highest degree a teacher earned is a high school diploma (Secondary), the years of service are 14.50 years—more than a teacher with a baccalaureate degree. Teachers who earn a vocational degree are predicted to serve 7.43 years longer than a teacher with a baccalaureate. Those teachers earning an associate degree serve 5.70 years less than teachers with an earned baccalaureate degree. In looking at graduate degrees, teachers who earn a masters degree serve .18 years longer than teachers with a baccalaureate. A teacher who earns a specialist degree serves 2.91 years longer than a baccalaureate degree holder, and those teachers who earn a doctorate serve 3.71 years less than those who earn a baccalaureate degree. Each of these values holds true only if every other factor is held constant.

When testing the different ethnicities of teachers, all ethnicities were compared to those teachers who are White, since White teachers represent a majority of the population. A teacher of Asian ethnicity was predicted to serve 2.20 years less than a White teacher. A Black teacher was predicted to serve 1.03 years less than a White teacher. Hispanic teachers were predicted to serve 2.22 years less than White teachers. When predicting the years of service of American Indian/Alaska Native teachers, they were predicted to serve 3.99 years less than white teachers. When compared to teachers who describe themselves as being Multiracial (two or more races), they were predicted to serve 0.24 years less than White teachers. The last ethnicity tested revealed that teachers who reported being Native Hawaiian/Pacific Islander were predicted to serve 16.55 years less than White teachers. As mentioned earlier, these values hold true only if every other factor is held constant.

*Model 1.6 Significance of Independent Variables*

The following Level 1 (teacher) independent variables tested as being statistically significant predictors ($p < .05$) of a teacher's professional longevity: age ($p < .001$), salary ($p < .001$), unknown degree ($p < .001$), associate degree ($p < .001$), doctorate degree ($p < .001$), Asian ethnicity ($p = .022$), Black ethnicity ($p = .041$), Hispanic ethnicity ($p < .001$), and Native Hawaiian/Pacific Islander ethnicity ($p = .002$). The following Level 1 (teacher) independent variables did not test as statistically significant ($p > .05$): a teacher's sex ($p = .342$), secondary degree ($p = .111$), vocational degree ($p = .318$), masters degree ($p = .646$), specialist degree ($p = .099$), and a teacher who is either American Indian/Alaska Native ($p = .064$) or Multiracial ($p = .858$). Therefore, there is no statistically significant difference in predicting the years of service of a Floridian high school science teacher between teachers of different sexes; those who have a secondary, vocational, masters, or specialist degree as compared to those who have a baccalaureate; or teachers who are American Indian/Alaska Native or Multiracial as compared to those teachers who are White.

## Correlations of Independent Variables Removed from Level 1 Analyses

Twelve independent variables were removed from the models of the Level 1 (teacher) analyses (see Appendix D for details). The removed independent variables included: "Florida Non-Public Years of Service," "Florida Public School Years of Service," "Out-of-State Public Years of Service," "Out-of-State Non-Public Years of Service," "Military Years of Service," "Administration Years of Service," "Current District Years of Service," "Current Assignment Years of Service," "Total Years of Service Outside Florida," "Total Years of Teaching," "Migration Count," and "Number of Places Taught.” These variables were removed due to the presence of multicollinearity ($r > 0.80$), non-significance in the model, high VIF values, or lack of representative literature in the research. Although these independent variables were not included in the final Level 1 model (Model 1.6), a correlation test was performed so as to determine what correlation existed between the twelve removed independent variables and the dependent variable. The two-tailed significance of the correlation coefficients was measured by $p < .05$.

*Results of Correlation of Removed Level 1 Variables*

The number of places at which a teacher taught during his or her final year of employment was not significant and is barely correlated with the Professional Longevity of a teacher in the Florida school system ($r = .009$, $p = .684$). The migration count (how many times a teacher moved between schools during the studied period) tested as statistically significant and was negatively correlated with the dependent variable ($r = –.046$, $p = .041$). The years of service a teacher serves in Florida’s non-public schools tested as statistically significant and was positively correlated ($r = .173$, $p < .001$). The amount of time a teacher serves in Florida’s public schools was positively correlated (and strongly so) with the dependent variable and tested as statistically significant ($r = .985$, $p < .001$). Regarding a teacher’s out-of-state service in public ($r = .077$, $p = .001$) and non-public schools ($r = .055$, $p = .013$), these variables tested statistically significant and were positively correlated with the dependent variable. Additionally, the total years of service in the military ($r = .054$, $p = .016$) and school administration ($r = .067$, $p = .003$) tested as statistically significant and were positively correlated with a teacher’s years of service in the Florida school system.

A teacher's time of service in his or her current district is statistically significant and is highly positively correlated to the dependent variable ($r$ = .908, $p$ < .001). The time of service in a teacher's current assignment also tested as statistically significant and was positively correlated (and strongly so) with a teacher's years of service in the Florida school system ($r$ = .700, $p$ < .001). Finally, a teacher's total years of service outside of the Florida school system ($r$ = .090, $p$ < .001) and total years of teaching ($r$ = .934, $p$ < .001) both tested as statistically significant and were positively correlated with the dependent variable. A summary of these findings for the correlation of the removed independent variables is seen in Table 10.

Table 10

*Correlation Data of Removed Level 1 (Teacher) Variables*

| Independent Variable[a] | *r* | *Sig.* |
|---|---|---|
| No. Places Taught | .009 | .684 |
| Migration Count | –.046 | .041 |
| Florida Non-Public School Years | .173 | <.001 |
| Florida Public School Years | .985 | <.001 |
| Out-of-State Non-Public School Years | .055 | .013 |
| Out-of-State Public School Years | .077 | .001 |
| Military Years | .054 | .016 |
| Administration Years | .067 | .003 |
| Current District Years | .908 | <.001 |
| Current Assignment Years | .700 | <.001 |
| Total Years of Service Outside Florida | .090 | <.001 |
| Total Years of Teaching | .934 | <.001 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

## Level 2 – School Variable MLR Results

Level 2 (school variables) of the multiple linear regression analysis was far less cumbersome than the first level of analysis. The primary reason for this is that there was far less substantive literature to validate when including these independent variables in the analysis (see Chapter II). Therefore, an extensive exploratory analysis, as conducted in the Level 1 (teacher) analysis, was not necessary for Level 2.

The variables included in the Level 2 (school) analysis are a school's average 9–12 grade class size, the school's charter status, a school's SES (measured by the percentage of free/reduced lunches), a school's geographic location, and a school's residential population density. The independent variables of a school's geographic location and residential population density were divided into "dummy" coding schemes in order to create categorical variables, since they are not continuous. For specifics on the variable coding scheme and results of the tests of assumptions for Model 2.1, refer to Appendix E. The following paragraphs report the results of the final Level 2 model.

*Model 2.1 Results*

A multiple linear regression was conducted to predict the professional longevity of a high school science teacher in Florida based upon eight independent variables. A significant regression equation was computed ($F(8, 1994) = 4.607$, $p < .001$), with an $R^2$ of .018. The model summary and coefficients for Model 2.1 are summarized in Table 11 and Table 12 respectively. A teacher's professional longevity is equal to 9.87 + .03 (Average Class Size) – 3.13 (Charter Status) – .03 (SES) – 1.41 (Suburb vs. City) – .91 (Suburb vs. Town) – 1.23 (Suburb vs. Rural) + .78 (Large/Fringe vs. Midsize/Distant) + 1.15 (Large/Fringe vs. Small/Remote).

*Model 2.1 Estimated Parameters*

According to the SPSS output, a teacher's professional longevity increases 0.03 years for every unit increase in a school's average class size when all other factors are held constant. When comparing a school's charter status, a teacher at a charter school serves 3.13 years less than a public school teacher when all other factors are held constant. In looking at a school's SES, a teacher's years of service decreases by 0.03 years every unit increase in SES when all other factors are held constant.

Table 11

*Model Summary of Level 2 School Independent Variables*

| Model[a] | *R* | $R^2$ | *SEE* | *F* | $df_1$ | $df_2$ | *Sig.* | *Durbin-Watson* |
|---|---|---|---|---|---|---|---|---|
| 1 | .135[b] | .018 | 9.772 | 4.607 | 8 | 1994 | <.001 | 1.931 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools). [b]Predictors: Average Class Size, Charter Status, SES, Suburb vs. City, Suburb vs. Town, Suburb vs. Rural, Large/Fringe vs. Midsize/Distant, and Large/Fringe vs. Small/Remote.

Table 12

*Coefficients for Model 2.1*

| Independent Variable[a] | *B* | *Sig.* |
|---|---|---|
| Constant | 9.87 | <.001 |
| Average Class Size | 0.03 | .177 |
| Charter Status | –3.13 | <.001 |
| SES | –0.03 | .009 |
| Suburb vs. City | –1.41 | .022 |
| Suburb vs. Town | –0.91 | .381 |
| Suburb vs. Rural | –1.23 | .048 |
| Large/Fringe vs. Midsize/Distant | 0.78 | .201 |
| Large/Fringe vs. Small/Remote | 1.15 | .135 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

In reviewing the geographic location of a school, all geographic locations were compared to schools in the suburbs, because that was the most recurring geographic location. If a teacher serves in a school located in a city, his or her predicted years of service are 1.41 years less than a teacher who serves in a school in the suburbs. For teachers teaching in a school in a town, the predicted years of service are 0.91 years less than a teacher teaching in the suburbs. Teachers who serve in rural schools are predicted to teach 1.23 years less than teachers teaching in suburban schools.

When testing the residential population densities of different schools, all population densities were compared to those schools that are Large/Fringe, since they represent the majority of the population. A teacher in a Midsize/Distant school is predicted to serve 0.78 years more a teacher serving in a Large/Fringe school. Finally, a teacher who teaches in a Small/Remote school is predicted to serve 1.15 years more than a teacher serving in a Large/Fringe school. As mentioned earlier, these values hold true only if all other factors are held constant.

*Model 2.1 Significance of Independent Variables*

The following Level 2 (school) independent variables tested as statistically significant predictors ($p < .05$) of a teacher's professional longevity: Charter Status ($p < .001$), SES ($p = .009$), City ($p = .022$), and Rural ($p = .048$). The following Level 2 (school) independent variables did not test as statistically significant ($p > .05$): a school's Average Class Size ($p = .177$), Town ($p = .381$), Midsize/Distant ($p = .201$), and Small/Remote ($p = .135$). Therefore, there is no statistically significant difference in predicting the professional longevity of a Floridian high school science teacher based on a school's average class size, schools that are located in towns as compared to the suburbs, or schools that are midsize/distant or small/remote as compared to schools that are large/fringe.

## Level 3 – District Variable MLR Results

Level 3 (district variables) of the multiple linear regression analysis was more straightforward than the second level of analysis, due to the presence of only two independent variables. The variables included in the Level 3 (district) analysis were a district's average SES and a district's average spending per 9–12-grade student. Both of these independent variables are quantitative continuous variables measuring the average percentage of the district's 9–12 grade student population of free/reduce lunch and the average spending in U.S. dollars per 9–12 grade student in the district. For specifics on the results of the tests of assumptions for Model 3.1, refer to Appendix F. The following paragraphs report the results of the final Level 3 model.

*Model 3.1 Results*

For Model 3.1, a multiple linear regression was conducted to predict the professional longevity of a high school science teacher serving in Florida based on two independent variables. A significant regression equation was computed (F(2, 2000) = 10.678, $p < .001$), with an $R^2$ of .010. The model summary and coefficients for Model 3.1 are summarized in Table 13 and Table 14 respectively. The studied teacher's predicted professional longevity is equal to 13.59 – .09 (Average SES) – 4.91 E–5 (Average Spending).

Table 13

*Model Summary of Level 3 District Independent Variables*

| Model[a] | *R* | $R^2$ | *SEE* | *F* | $df_1$ | $df_2$ | *Sig.* | *Durbin-Watson* |
|---|---|---|---|---|---|---|---|---|
| 1 | .103[b] | .011 | 9.795 | 10.678 | 2 | 2000 | .000 | 1.938 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools). [b]Predictors: Average SES and Average Spending.

*Model 3.1 Estimated Parameters*

According to the SPSS output, a teacher's predicted years of service decreased 0.09 years for every unit increase in a district's average SES when all other factors are

Table 14

*Coefficients for Model 3.1*

| Independent Variable[a] | *B* | *Sig.* |
|---|---|---|
| Constant | 13.59 | <.001 |
| Average SES | –0.09 | <.001 |
| Average Spending | –4.91 E–5 | .187 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

held constant. When comparing a district's average spending per 9–12 grade student, a teacher is predicted to serve 0.0000491 years less for every dollar increase in a district's spending when all other factors are held constant.

*Model 3.1 Significance of Independent Variables*

The following Level 3 (district) independent variable test as a statistically significant predictor ($p < .05$) of a teacher's professional longevity: district's SES ($p < .001$). The following district-level independent variable did not test as statistically significant ($p > .05$): a district's average spending per student ($p = .187$). Therefore, there is no statistically significant difference in predicting the professional longevity of a Floridian high school science teacher based on a district's average spending on its 9–12-grade students.

## Hierarchical Multiple Regression Results

Now that I have established three statistical models (teacher, school, and district), it is necessary to analyze the statistically significant variables in a hierarchy. A hierarchical model is appropriate to test, since I am working with variables that are not on the same level in the realm of education. Level 1 variables are those that are either directly related to the teacher or one they can control. Level 2 variables represent choices made by the school where the teacher agrees to serve. Level 3 variables represent choices made by the district where the teacher agrees to serve. The variables included in the hierarchical multiple regression analysis are the ones which tested as statistically significant in the previous models. These variables are: a teacher's age, salary, earned degree (unknown, associate, and doctorate), ethnicity (Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander); a school's charter status, SES, and geographic location (city and rural); and a district's average SES. For specifics on the variable coding scheme and results of the tests of assumptions for the HMR, refer to Appendix G. The following paragraphs report the results of the final HMR model.

*Model 4.1 Results*

For Model 4.1, a hierarchical multiple regression was conducted to predict the professional longevity of a high school science teacher in Florida based on 14 independent variables. Three significant regression equations were computed. For Step 1 ($F(9, 1993) = 169.995$, $p < .001$), with an $R^2$ of .434. Step 2 produced the equation: ($F(13, 1989) = 120.664$, $p < .001$), with an $R^2$ of .441. The final equation for Step 3 produced: ($F(14, 1988) = 114.517$, $p < .001$), with an $R^2$ of .446. The model summaries and coefficients for Model 4.1 are summarized in Table 15 and Table 16 respectively. The final equation (Step 3) for the studied teacher's predicted professional longevity is equal to –6.78 + .42 (Age) + 8.16 E–5 (Salary) – 3.91 (Baccalaureate vs. Unknown) – 5.45 (Baccalaureate vs. Associate) – 3.79 (Baccalaureate vs. Doctorate) – 1.67 (White vs. Asian) – .59 (White vs. Black) – 1.67 (White vs. Hispanic) – 10.82 (White vs. Native Hawaiian/Pacific Islander) – 2.03 (Charter Status) + .001 (School SES) – .09 (Suburb vs. City) – .56 (Suburb vs. Rural) – .09 (District SES).

Table 15

*Model Summary of HMR Significant Variables*

| Model[a] | *R* | $R^2$ | *SEE* | *F* | $df_1$ | $df_2$ | *Sig.* | *Durbin-Watson* |
|---|---|---|---|---|---|---|---|---|
| 1 | .659[b] | .434 | 7.419 | 169.995 | 9 | 1993 | <.001 | |
| 2 | .664[c] | .441 | 7.383 | 5.868 | 4 | 1989 | <.001 | |
| 3 | .668[d] | .446 | 7.349 | 19.934 | 1 | 1988 | <.001 | 1.991 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools). [b]Predictors: Age, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Associate, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. Native Hawaiian/Pacific Islander. [c]Predictors: Age, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Associate, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. Native Hawaiian/Pacific Islander, Charter Status, School SES, Suburb vs. City, Suburb vs. Rural. [d]Predictors: Age, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Associate, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. Native Hawaiian/Pacific Islander, Charter Status, School SES, Suburb vs. City, Suburb vs. Rural, District SES.

Table 16

*Coefficients for Model 4.1*

| Independent Variable[a] | *B* | *Sig.* |
|---|---|---|
| Step 1 | | |
| Constant | –11.65 | <.001 |
| Age | 0.42 | <.001 |
| Salary | 7.78 E–5 | <.001 |
| Baccalaureate vs. Unknown | –4.41 | <.001 |
| Baccalaureate vs. Associate | –5.69 | <.001 |
| Baccalaureate vs. Doctorate | –3.79 | <.001 |
| White vs. Asian | –2.14 | .025 |
| White vs. Black | –0.97 | .054 |
| White vs. Hispanic | –2.22 | <.001 |
| White vs. Native Hawaiian | –11.75 | .006 |
| Step 2 | | |
| Constant | –10.45 | <.001 |
| Age | 0.42 | <.001 |
| Salary | 7.79 E–5 | <.001 |
| Baccalaureate vs. Unknown | –4.37 | <.001 |
| Baccalaureate vs. Associate | –6.03 | <.001 |

Table 16 (continued).

| | | |
|---|---|---|
| Baccalaureate vs. Doctorate | –3.79 | <.001 |
| White vs. Asian | –1.92 | .044 |
| White vs. Black | –0.58 | .260 |
| White vs. Hispanic | –1.91 | .001 |
| White vs. Native Hawaiian | –11.66 | .006 |
| Charter Status | –2.18 | <.001 |
| School SES | –0.02 | .017 |
| Suburb vs. City | 0.11 | .770 |
| Suburb vs. Rural | –0.61 | .191 |
| Step 3 | | |
| Constant | –6.78 | <.001 |
| Age | 0.42 | <.001 |
| Salary | 8.16 E–5 | <.001 |
| Baccalaureate vs. Unknown | –3.91 | <.001 |
| Baccalaureate vs. Associate | –5.45 | <.001 |
| Baccalaureate vs. Doctorate | –3.79 | <.001 |
| White vs. Asian | –1.67 | .080 |
| White vs. Black | –0.59 | .247 |
| White vs. Hispanic | –1.67 | .005 |
| White vs. Native Hawaiian | –10.82 | .011 |
| Charter Status | –2.03 | .001 |
| School SES | 0.00 | .956 |
| Suburb vs. City | –0.09 | .809 |
| Suburb vs. Rural | –0.56 | .224 |
| District SES | –0.09 | <.001 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

*Model 4.1 Estimated Parameters*

According to the final (Step 3) SPSS output, a teacher’s predicted years of service increases 0.42 years for every year a teacher aged when all other factors are held constant. In reviewing a teacher’s salary, the years of service increases by 0.0000816 years for every dollar increase in salary when all other factors are held constant. Regarding earned degrees of a teacher, all degrees were compared to a baccalaureate degree because it was the most recurring degree. If a teacher did not report his or her degree (Unknown), the predicted years of service is 3.91 years less than a teacher with a baccalaureate degree. Those teachers who earned an associate degree served 5.45 years less than teachers with an earned baccalaureate degree. In looking at graduate degrees, teachers who earned a doctorate served 3.79 years less than those who earned a baccalaureate degree. Each of these values holds true if every other factor is held constant.

When testing the different ethnicities of the teachers, all ethnicities were compared to those teachers who are White, since White teachers represent a majority of the population. A teacher of Asian ethnicity is predicted to serve 1.67 years less than a White teacher. A Black teacher is predicted to serve 0.59 years less than a White teacher. Hispanic teachers are predicted to serve 1.67 years less than a White teacher. The last ethnicity tested revealed that teachers who reported being Native Hawaiian/Pacific Islander are predicted to serve 10.82 years less than a White teacher. As mentioned earlier, these values only hold true if every other factor is held constant.

When testing the Level 2 variables, teachers who work at a charter school are predicted to serve 2.03 years less than teachers who serve at a public school. A school's SES affects a teacher's years of service by predicting an increase of 0.001 years for every unit increase of the school's SES. Regarding the geographic location of a school, all geographic locations are compared to those teachers who teach in suburban schools, since those schools represent a majority of the population. Teachers who teach in city schools are predicted to serve 0.09 years less than teachers serving in suburban schools, whereas rural school teachers are predicted to serve 0.56 years less than teachers serving in schools in the suburbs. Finally, for every unit increase in a district's SES, a teacher's years of service is predicted to decrease by 0.09 years. Again, these values only hold true if every other factor is held constant.

*Model 4.1 Significance of Independent Variables*

In Step 3 of the final model, the following independent variables tested as statistically significant predictors ($p < .05$) of a teacher's professional longevity: age ($p < .001$), salary ($p < .001$), unknown degree ($p < .001$), associate degree ($p < .001$), doctorate degree ($p < .001$), Hispanic ethnicity ($p = .005$), Native Hawaiian/Pacific Islander ethnicity ($p = .011$), charter status ($p = .001$), and a district's average SES ($p < .001$). The following independent variables did not test as statistically significant ($p > .05$): a teacher who is Asian ($p = .080$) or Black ($p = .247$), a school's SES ($p = .956$), and whether a school was in the city ($p = .809$) or rural ($p = .224$). Therefore, there is no statistically significant difference in predicting the professional longevity of a Floridian high school science teacher who is Asian or Black compared to those teachers who are White; a school's SES; or if the school is located in a city or rural setting.

## Summary of Results

In summary, several multiple linear regression analyses were performed, in an effort to determine what factors influence, statistically, the professional longevity of high school science teachers in Florida. The dependent variable in this study was the professional longevity of a high school science teacher in the state of Florida. Due to the large number of independent variables present in the study and the nature of education, the independent variables were separated into three levels. Leve1 1 (teacher variables) included a teacher's: age, sex, salary, ethnicity, earned degree, number of places taught, migration count, years of service in Florida's public and non-public schools, years of service in out-of-state public and non-public schools, years of military service, years of school administration service, years of service in the current assignment and district, total years of service outside of Florida, and total years of teaching. The Level 2 (school variables) included a school's: geographic location, residential population density, average 9–12 grade class size, charter status, and SES. The Level 3 (district variables) included a district's: average SES and average spending per 9–12 grade student.

*Level 1 (Teacher Variables) Results Summary*

The multiple linear regression of the Level 1 independent variables required that several exploratory models of testing needed to occur in order to determine which variables exhibited multicollinearity and were not ultimately statistically significant in the final model (Model 1.6). It was determined a teacher's sex, ethnicity (American Indian/Alaska Native and Multiracial), earned degree (secondary, vocational, masters, and specialist), number of places taught, migration count, years of service in Florida's public and non-public schools, years of service in out-of-state public and non-public schools, years of military service, years of administration service, years of service in the current assignment and district, total years of service outside of Florida, and total years of teaching were not statistically significant. Therefore, the aforementioned variables were removed when the hierarchical multiple regression (HMR) was performed. The Level 1 variables carried over in the HMR analysis were a teacher's: age, salary, ethnicity (Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander), and earned degree (unknown, associate, and doctorate).

*Correlation of Removed Level 1 Variables Results Summary*

Since there were many independent variables removed from the final Level 1 model (Model 1.6), I feel it is necessary to, at minimum, report any correlations that exist in these independent variables when compared to the dependent variable. The only variable that was not statistically significant in its correlation was the number of places a teacher taught during his or her last year of employment. The following variables tested as statistically significant in their correlation to the dependent variable: “Migration Count,” “Florida Non-Public School Years of Teaching,” “Florida Public School Years of Teaching,” “Out-of-State Public School Years of Teaching,” “Out-of-State Non-Public School Years of Teaching,” “Years of Military Service,” “Years of Service in School Administration,” “Years in Current District,” “Years in Current Assignment,” “Total Years of Service Outside of Florida,” and “Total Years in the Teaching Profession.” Of the statistically significant variables, “Florida Non-Public School Years of Teaching,” “Florida Public School Years of Teaching,” “Out-of-State Public School Years of Teaching,” “Out-of-State Non-Public School Years of Teaching,” “Years of Military Service,” “Years of Service in School Administration,” “Years in Current District,” “Years in Current Assignment,” “Total Years of Service Outside of Florida,” and “Total Years in the Teaching Profession” were all positively correlated with the dependent variable. Only a teacher’s “Migration Count” was negatively correlated with the dependent variable.

*Level 2 (School Variables) Results Summary*

A multiple linear regression of the Level 2 independent variables was conducted in order to determine which variables were statistically significant. Multiple exploratory analyses were not needed, as in Level 1, because there is research available to suggest these independent variables influence the dependent variable. It was determined that a school's: "Average Class Size," "Geographic Location" (Town), and "Population Density" (Midsize/Distant and Small/Remote) are not statistically significant. Therefore, the aforementioned variables were removed when performing the HMR. The Level 2 variables carried over in the HMR analysis were a school's "Charter Status," "SES," and "Geographic Location" (City and Rural).

*Level 3 (District Variables) Results Summary*

A multiple linear regression of the Level 3 independent variables was conducted in order to determine which variables were statistically significant. Multiple exploratory analyses were not needed, as in Level 1, because there is research available to suggest that these independent variables influence the dependent variable. It was determined that a district's average spending per student is not statistically significant. Therefore, the aforementioned variable was removed when the HMR was performed. The Level 3 variable that was carried over in the HMR testing is a district's SES. With the inclusion of a district's SES, a total of 14 variables were tested in the HMR analysis.

*HMR (All Previously Significant Variables) Results Summary*

A hierarchical multiple regression of statistically significant Level 1, Level 2, and Level 3 independent variables was conducted in order to determine which variables were statistically significant. Variables from similar levels were entered into a unique block (step) for testing in a HMR analysis. Since there were three levels previously tested, three blocks were created to conduct the HMR. Block 1 contains the statistically significant Level 1 teacher variables. Block 2 contains the statistically significant Level 2 school variables. Finally, Block 3 contains the statistically significant Level 3 district variables. In the final step of the HMR, it was determined that a teacher's ethnicity (Asian and Black) and a school's SES and geographic location (city and rural) are not statistically significant. Therefore a teacher's age, salary, ethnicity (Hispanic and Native Hawaiian/Pacific Islander), earned degree (unknown, associate, and doctorate), a school's charter status, and a district's average SES are all statistically significant in predicting the professional longevity of a high school science teacher in Florida.

## How Results Relate to Research Hypotheses

The purpose of this study is to determine what factors influence the professional longevity of high school science teachers in Florida. Therefore, it becomes imperative that the previous results be connected to the research hypotheses of this study, in order to fulfill its purpose. Each research hypothesis will now be restated and the data will be used to explain whether the data support the rejection or adoption of the various hypotheses.

### *Research Hypothesis 1 Results*

The first research hypothesis of this study is as follows: $H_1$ – There are statistically significant differences in Level 1 (teacher variables) that influence the professional longevity of a high school science teacher in Florida. Based upon the results of the Level 1 analysis, a statistically significant equation was produced and it was determined that a teacher's age, salary, ethnicity (Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander), and earned degree (unknown, associate, and doctorate) are statistically significant and influence professional longevity of high school science teachers in Florida. Therefore, the first research hypothesis, $H_{1,}$ is supported due to the presence of statistically significant factors.

*Research Hypothesis 2 Results*

The second research hypothesis of this study is as follows: $H_2$ – There are statistically significant differences in Level 2 (school variables) that influence the professional longevity of a high school science teacher in Florida. Based upon the results of the Level 2 analysis, a statistically significant equation was produced and it was determined that a school's charter status, SES, and geographic location (city and rural) were statistically significant and influenced the professional longevity of a high school science teacher in Florida. Therefore, it is appropriate to accept the second research hypothesis, $H_2$, due to the presence of statistically significant factors.

*Research Hypothesis 3 Results*

The third research hypothesis of this study is as follows: $H_3$ – There are statistically significant differences in Level 3 (district variables) that influence the professional longevity of a high school science teacher in Florida. Based upon the results of the Level 3 analysis, a statistically significant equation was produced and it was determined that a district's SES is statistically significant and influences the professional longevity of a high school science teacher in Florida. Therefore, the third research hypothesis, $H_3$, is accepted due to the presence of statistically significant factors.

*Research Hypothesis 4 Results*

The final research hypothesis of this study is as follows: $H_4$ – When tested in a hierarchical multiple regression, there were found to be statistically significant differences in Level 1, Level 2, or Level 3 that influence the professional longevity of a high school science teacher in Florida. Although all factors entered into the HMR were statistically significant in the previous three levels, not all were statistically significant in the final HMR model. Based upon the results of the HMR analysis, a statistically significant equation was produced and it was determined that a teacher's age, salary ethnicity (Hispanic and Native Hawaiian/Pacific Islander), earned degree (unknown, associate, and doctorate), a school's charter status, and a district's average SES are statistically significant, and influence the professional longevity of a high school science teacher in Florida. Therefore, there is evidence to support the fourth research hypothesis, $H_{04}$.

# CHAPTER V – CONCLUSION

## Restatement of Purpose

The purpose of this study is to determine what factors influence the professional longevity of high school science teachers in Florida by supporting four research hypotheses. In order to support the first three research hypotheses, this study is designed to explore three different levels, which occur frequently in the realm of education, the teacher, school, and school district. Upon determining what factors are statistically significant in predicting the professional longevity on each of the three levels, the fourth research hypothesis is supported by conducting a HMR analysis with the previously determined significant factors from the three levels.

## Discussion

### *Overview of the Data*

With the final data set completed, I am amazed by the fact the dependent variable (Professional Longevity) is not normally distributed. Instead, the data are heavily skewed right, indicating that a majority of teachers had relatively few years of service. However, as I recall the reviewed literature, I am also surprised to see that the final data set follows what other researchers have found (Ingersoll, 2003; Ingersoll & Smith, 2003a; Lindqvist et al., 2014, U.S. Department of Education, 2004). That is, in the final data set, 52.2% of the science teacher population ($f$ = 1,045) left the Florida educational workforce within their first five years of teaching. Those data are displayed in Table 4 of Chapter IV.

Additionally, I am intrigued by the fact that the majority of teachers in the data set did not have graduate degrees. Of the 2,003 teachers within the data set, only 32.3% ($f$ = 626) earned a degree higher than a college baccalaureate. However, the percentage of teachers who earned graduate degrees also followed the reviewed literature (Hughes, 2012). According to those writings, most teachers earn a graduate degree simply to receive a salary increase, with no guarantee they will stay within the profession (Chingos & Peterson, 2010; Henry et al., 2013). A summary of the average professional longevity, separated by degree, is found in Table 17. As we can see in Table 17, only 210 teachers (34%) of those who earn a graduate degrees (greater than baccalaureate) served in the Florida education system longer than their category's average years of service.

Table 17

*Average Years of Service by Earned Degree*

| Earned Degree | $f$ | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ |
|---|---|---|---|
| Unknown | 59 | 3.81 | 20 |
| Secondary | 1 | 1.00 | 0 |
| Vocational | 1 | 26.00 | 0 |
| Associate | 29 | 3.86 | 11 |
| Baccalaureate | 1,287 | 7.59 | 433 |
| Masters | 537 | 11.01 | 176 |
| Specialist/Advanced Masters | 18 | 15.12 | 5 |
| Doctorate | 71 | 7.83 | 29 |

Note. No. > $\bar{X}_{ys}$ represents the number of teachers who served a greater number of years of service than their category's mean.

*Level 1 MLR Discussion*

The initial number of variables within the Level 1 MLR is massive. However, after several runs of the MLR, the final model included only 16 of the original 28 independent variables. Ultimately the removed variables from the Level 1 analysis include the teacher's sex, the number of places a teacher taught, a teacher's migration count, Florida public years of service, Florida non-public years of service, out-of-state public years of service, out-of-state non-public years of service, years of military service, years of service in school administration, years of service in current district, years of service in current assignment, total years of teaching, and total years of teaching outside of Florida (see Appendix D for details).

*Unsupported independent variables*. In reviewing the variables that represent the various “years of service,” it is not difficult to see why they are not included in the final model. First, many of the “years of service” variables exhibit either multicollinearity ($r > 0.8$), low tolerance values ($1/VIF < 0.2$), or are not statistically significant ($p > .05$). A summary of these values is found in Table 18. A high $r$ or low 1/VIF value means that the variable is highly correlated with the dependent variable. It seems obvious that these variables would not work in the final model, since their inclusion would produce a model with an $R^2$ value of near or equal to 1.00. Therefore, the model would not produce a true picture of the factors that truly do influence the professional longevity of a high school science teacher. Second, with the exception of migration count and number of places taught, I cannot find any evidence within the literature to suggest that the inclusion of these variables in the final model would be worthwhile.

*Sex Independent Variable.* A variable that is not statistically significant in the final model is a teacher’s sex. I was unsure how this variable would test statistically in the final model. There are researchers who have found the sex of a teacher to be statistically significant (Borman & Dowling, 2008; Smith & Ingersoll, 2004) and others who have found that it is not statistically significant (Boyd, Grossman, Ing, Lankford, Loeb et al., 2011). In looking at the population of teachers within the data set 1,258 (63%) were female and 745 (37%) were male. If there are more female teachers leaving the school system, why was there not a statistically significant finding? In looking at the average professional longevity of each sex, it was discovered that males serve on average

Table 18

*Summary of Unsupported Level 1 Variables*

| Independent Variable | *r* | 1/VIF | *Sig.* |
|---|---|---|---|
| No. Places Taught | .009 | .967 | .675 |
| Migration Count | –.046 | .961 | .153 |
| Florida Public Years | .985 | .134 | . |
| Florida Non-Public Years | .173 | .972 | . |
| Out-of-State Public Years | .000 | .448 | . |
| Out-of-State Non-Public Years | .007 | .884 | . |
| Military Years | .054 | .963 | .209 |
| Administration Years | .067 | .964 | .631 |
| Current District Years | .908 | .321 | .052 |
| Current Assignment Years | .700 | .405 | .302 |
| Total Years Outside of Florida | .090 | .000 | . |
| Total Years of Teaching | .934 | .106 | . |

Note. The "." symbol indicates SPSS did not return a value because an *F* statistic could not be calculated.

9.23 years and females serve on average 7.94 years. Therefore, there is no statistical difference between male and female teachers' professional longevity; because there were more female teachers that served, on average, fewer years than the fewer number of male teachers combined. A table summarizing these findings is seen in Table 19. Additionally, we see in Table 19 that 455 female teachers served longer than their sex's average professional longevity and 259 male teachers served longer than their sex's average professional longevity. When computing the percentage of the population of each category, this means that 36% and 35% of female and male teachers, respectively, served longer than their sex's average years of service. This underscores the finding that there is no statistical difference in predicting the professional longevity of a high school science teacher in Florida based on sex.

Table 19

*Summary of Sex Independent Variable*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ | *Sig.* |
|---|---|---|---|---|
| Sex | | | | .342 |
| Female | 1,258 | 7.94 | 455 | |
| Male | 745 | 9.23 | 259 | |

Note. No. > $\bar{X}_{ys}$ represents the number of teachers who served a greater number of years of service than their category's mean.

*Level 1 final model non-significant variables*. Of the 16 variables placed in the final model, seven of them, when tested, were found to not be statistically significant in the final model. Those Level 1 independent variables include a teacher's sex, earned degree (secondary, vocational, masters, and specialist), and ethnicity (American Indian/Alaska Native and Multiracial). Since the statistical significance of a teacher's sex was already discussed, I will discuss the independent variables of a teacher's earned degree and ethnicity.

### *Non-Significant Earned Degrees*

It is easy to see why there was no statistical difference found when predicting the years of service of a teacher when the teachers' highest degree is a secondary, vocational, masters, or specialist. First, it is important to remember that since a "dummy" coding scheme was used in order to create categorical variables, all degrees were compared to teachers whose highest degree is a baccalaureate, because those teachers represent the majority of the population. Again, I was unsure how these variables would test statistically, since the literature suggests that holders of a graduate degree generally are more likely than most teachers to leave the teaching profession (Hughes, 2012).

However, within this study, two (masters and specialist) out of the three graduate degrees tested were found to not be statistically significant. Why would this be the case?

When looking at the data set, one teacher's highest degree was a secondary degree, one teacher held a vocational degree, 537 held a master's degree, and 18 held a specialist degree. Thus, there are very few holders whose highest degree is a secondary, vocational, or specialist degree. Therefore, it is unlikely to find that their professional longevity is statistically different from teachers whose highest degree is a baccalaureate. When observing the master's degree holders, there were many more. However, the overall population (176, 33%) of teachers who served longer than their category's average years of service is nearly the same as those whose highest degree was a baccalaureate (433, 34%). Therefore, it is clear to see that there is no statistical difference between teachers whose highest degree is a master's and those whose highest degree is a baccalaureate. These data are summarized in Table 20.

Table 20

*Summary of Non-Significant Degree Variables*

| Independent Variable | *f* | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ | *Sig.* |
|---|---|---|---|---|
| Degree | | | | |
| Secondary | 1 | 1.00 | 0 | .111 |
| Vocational | 1 | 26.00 | 0 | .318 |
| Masters | 537 | 11.01 | 176 | .646 |
| Specialist/Advanced Masters | 18 | 15.12 | 5 | .099 |

Note. The Baccalaureate degree values are as follows: *f* = 1,287, $\bar{X}_{ys}$ = 7.59, and No. > $\bar{X}_{ys}$ = 433.

### *Non-Significant Ethnicities*

In reviewing the results of the final model of the Level 1 independent variables, two ethnicities tested were found to be statistically non-significant variables in predicting the professional longevity of high school science teachers in Florida. All ethnicities were compared to White ethnicity, because those teachers represent the majority of the teaching population. This comparison was necessary in order to use a “dummy” coding scheme to create categorical variables from the different ethnicities.

The two ethnicities that were found to not be statistically significant were teachers who identified themselves as either American Indian/Alaska Native or Multiracial. Within the data set there are 12 teachers who identified themselves as American Indian/Alaska Native and 31 teachers who identified as Multiracial. When you compare these numbers against the 1,452 teachers who identified as White, you see that there is not much probability of a statistically significant difference between the professional longevity of those two ethnicities and those teachers who are White. Furthermore, when comparing the number and percentage of American Indian/Alaska Native and Multiracial teachers who served longer than their category’s average years of service (4, 33% and 10, 32% respectively), they are nearly identical to the percentage of White teachers who served longer than their category’s average years of service (507, 35%). A summary of this information is found in Table 21.

Table 21

*Summary of Non-Significant Ethnicity Variables*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ | *Sig.* |
|---|---|---|---|---|
| Ethnicity | | | | |
| American Indian/Alaska Native | 12 | 6.08 | 4 | .064 |
| Multiracial | 31 | 7.23 | 10 | .858 |

Note. The White ethnicity values are as follows: $f$ = 1,452, $\bar{X}_{ys}$ = 9.43, and No. > $\bar{X}_{ys}$ = 507.

*Level 1 Final Model Significant Variables*. Nine of the 16 independent variables tested in the final model were found to be statistically significant. These variables are a teacher’s age; salary; unknown, associate, and doctorate degree; and the Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander ethnicities. The resulting final equation for the Level 1 model is as follows: a Florida high school science teacher's professional longevity is equal to – 11.54 + .42 (Age) – .33 (Sex) + 7.80 E–5 (Salary) – 4.41 (Baccalaureate vs. Unknown) + 14.50 (Baccalaureate vs. Secondary) + 7.43 (Baccalaureate vs. Vocational) – 5.70 (Baccalaureate vs. Associate) + .18 (Baccalaureate vs. Masters) + 2.91 (Baccalaureate vs. Specialist) – 3.71 (Baccalaureate vs. Doctorate) – 2.20 (White vs. Asian) – 1.03 (White vs. Black) – 2.22 (White vs. Hispanic) – 3.99 (White vs. American Indian/Alaska Native) – .24 (White vs. Multiracial) – 16.55 (White vs. Native Hawaiian/Pacific Islander). The following paragraphs discuss the results of the statistically significant independent variables.

### *Age as a Significant Predictor*

According to the final regression equation, for every unit increase in a teacher's age, a teacher's predicted professional longevity increases by nearly half of a year (0.42). First, what is intriguing to see is the imbalance in the amount of time between the predictor and the dependent variable. At first glance, it would appear that for every year a teacher ages, he or she gains at least 0.42 of an academic year of teaching. However, from the literature, we are reminded that all teachers eventually retire from the profession (Ingersoll & Perda, 2010; Macdonald, 1999). Indeed, most do not continue to teach until the day they die. However, the age of an individual did test with a significance value of $p < .001$. So what is happening with the age of a teacher? Put another way, why is the age of a teacher directly related to the predicted professional longevity instead of inversely related? It is expected that as a teacher ages, his or her years of service would decrease. In order to better understand the data, we need to consult Table 22.

Table 22

*Distribution of Teachers' Ages within the Data Set*

| Age Range | *f* | % Pop. |
|---|---|---|
| 21–25 | 147 | 7.34 |
| 26–30 | 289 | 14.43 |
| 31–35 | 293 | 14.63 |
| 36–40 | 224 | 11.18 |
| 41–45 | 195 | 9.74 |
| 46–50 | 177 | 8.84 |
| 51–55 | 176 | 8.79 |
| 56–60 | 181 | 9.04 |
| 61–65 | 212 | 10.58 |
| 66–70 | 83 | 4.14 |
| 71–75 | 21 | 1.05 |
| 76–80 | 4 | 0.20 |
| $x > 81$ | 1 | 0.04 |
| Total | 2003 | 100.00 |

In Table 22, the age of a teacher is not normally distributed. The average age of the science teacher population is 44, which is similar to the findings of Skaalvik and Skaalvik (2011) in their study. Of the entire population, 57.3% of the teachers are age 45 or younger. What is even more intriguing is that the remaining 42.7% of the population is 46 years or older. The numbers in their categories gradually increase until reaching the age range of 66–70, where the frequency returns to decreasing. Therefore, there exists almost a bimodal distribution of the teachers' ages. This bimodal distribution is seen in Figure 3. Since the population is heavily weighted in the "young" region of ages, the final coefficient from the model is positive because it is expected that younger teachers will serve longer than older teachers. The age ranges continue to decrease in numbers until the age range 56–60, where we see an increase again. What continues to cause the model's final coefficient to be positive is that the age ranges reverse course and becomes more populated until the 66–70 age range. Therefore, although they are not equal in population, the trend reverses and thereby creates a situation where there are two separate age ranges with had large distributions of teachers.

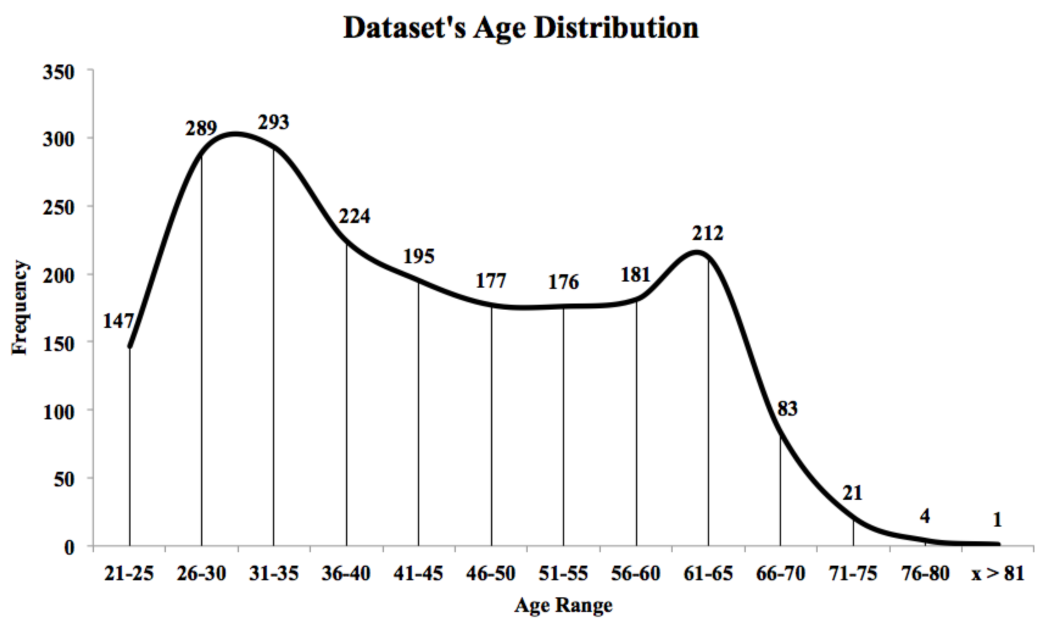


*Figure 3.* Graph representation of data set's age distribution.

Note. The distribution of the teachers' ages appears to be bimodal for the studied data set.

*Salary as a Significant Predictor*

It does not come as a surprise that a teacher's salary is a statistically significant predictor of a teacher's professional longevity. The existing literature shows that salary is typically a significant factor in predicting attrition (Gilpin, 2011; Harris & Adams, 2007; Imazeki, 2005; Ingersoll & Perda, 2010; Ng & Peter, 2010; Scheopner, 2010). However, I am amazed by how small the coefficient (7.80 E–5) was in the final model. Expanding out the scientific notation yielded 0.0000780, meaning that for every unit increase in salary (for every one U.S. dollar), a teacher's predicted years of service increases by

0.0000780 years. Expanding further upon this, if an employer increased the salary of a teacher by \$100,000, the school system is predicted to get only 7.8 years of additional professional longevity from the teacher. To put this into a realistic perspective, a \$10,000 increase in salary would increase a teacher's professional longevity by 0.78 years. From these facts, it is no surprise that 76.4% of teachers receive a salary less than or equal to \$40,000. The summary data for teachers' salaries is found in Table 23.

Table 23

*Distribution of Teachers' Salaries*

| Salary Range | *f* | % Pop. |
|---|---|---|
| \$0 – \$10,000 | 77 | 3.84 |
| \$10,001 – \$20,000 | 479 | 23.91 |
| \$20,001 – \$30,000 | 504 | 25.16 |
| \$30,001 – \$40,000 | 471 | 23.51 |
| \$40,001 – \$50,000 | 282 | 14.08 |
| \$50,001 – \$60,000 | 100 | 4.99 |
| \$60,001 – \$70,000 | 64 | 3.20 |
| \$70,001 – \$80,000 | 21 | 1.06 |
| \$80,001 – \$90,000 | 2 | 0.10 |
| \$90,001 – \$100,000 | 0 | 0.00 |
| $x >$ \$100,001 | 3 | 0.15 |
| Total | 2003 | 100.00 |

Although the data are heavily skewed right, I feel the data are representative of what is in the literature. My one reservation is how these numbers were collected. During the studied period, FLDOE changed the way it recorded a teacher's salary. For the academic years 2011–2012 and 2012–2013, FLDOE recorded a teacher's salary as amount per pay period. In the academic year 2013–2014 and beyond, FLDOE reports the teacher's annual salary. Therefore, the salaries for the 2011–2012 and 2012–2013 academic years needed to be calculated. After speaking to a representative at FLDOE, I was given a formula to determine the annual salary of a teacher during the two aforementioned academic years. My concern is that the formula, in 90 instances, produced salaries above average Florida salaries (greater than $60,000). However, since this formula was given to me by FLDOE, those salaries were kept in the final data set. It is unknown how these calculations affected the results for salary significance.

### *Earned Degree as a Significant Predictor*

When compared to a baccalaureate degree, an unknown, associate, and doctorate degree all were found to be statistically significant predictors of a Florida high school science teacher's professional longevity. The literature clearly states that graduate degrees (higher than baccalaureate) do not guarantee a teacher will remain in the education profession (Hughes, 2012). However, two of the three degrees shown to be statistically significant are not graduate degrees. First, none of these degrees is well represented in the population: unknown (58, 2.90%), associate (29, 1.45%), and doctorate (71, 3.54%). However, the average years of service of each of these degrees are lower than the population's average years of service, 8.42 years. Therefore, it is no surprise that each of these degrees was found to be statistically significant. A summary of the data is found in Table 24.

What is intriguing is that teachers whose highest degree is unknown (degree was not reported), associate, or a doctorate are predicted to serve 4.41, 5.70, and 3.71 fewer years, respectively, than a teacher whose highest degree is a baccalaureate. This trend is seen in the unknown and associate degree holders because their category's average professional longevity (3.81 and 3.86 respectively) is far less than the baccalaureate

Table 24

*Summary of Significant Earned Degrees*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ | *Sig.* |
|---|---|---|---|---|
| Degree | | | | |
| Unknown | 58 | 3.81 | 20 | <.001 |
| Associate | 29 | 3.86 | 11 | <.001 |
| Doctoral | 71 | 7.83 | 29 | <.001 |

Note. The Baccalaureate degree values are as follows: $f$ = 1,287, $\bar{X}_{ys}$ = 7.59, and No. > $\bar{X}_{ys}$ = 433.

average years of service (7.59). The only exception to this trend is the group of teachers who hold a doctoral degree. However, the average salary received by each earned degree could further explain this phenomenon. This is possible since the average salary of a teacher with a doctorate is $33,205, whereas a teacher whose highest degree is a baccalaureate is $29,691.

### *Ethnicity as a Significant Predictor*

Of the various tested ethnicities in the final model, four of them were found to be statistically significant factors in predicting the professional longevity of a high school science teacher in Florida. The four statistically significant ethnicities are Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander. All ethnicities were compared to White ethnicity in an effort use a “dummy” coding scheme to create categorical variables. White ethnicity was used as the base comparison because White teachers represent the majority of the data set’s population.

In comparing the four ethnicities with White ethnicity, it is easy to see why these four ethnicities were found to be statistically significant. First, the four ethnicities have low representation within the data set when compared to teachers who are White. Within the data set there are 63 Asian, 262 Black, 180 Hispanic, and 3 Native Hawaiian/Pacific

Islander teachers, compared to 1,452 White teachers. Second, the average years of service for each of these ethnicities are lower than the average years of service for those teachers who are White. On average, Asian teachers serve 5.11 years, Black teachers 6.27 years, Hispanic teachers 5.02 years, and Native Hawaiian/Pacific Islander teachers 0.67 years. White teachers serve on average 9.43 years. A summary from these facts is seen in Table 25. From the final Level 1 model, when compared to teachers who are White, Asian teachers are predicted to serve 2.20 years less than White teachers, Black teachers are predicted to serve 1.03 years less than White teachers, Hispanic teachers are predicted to serve 2.22 years less than White teachers, and Native Hawaiian/Pacific Islander teachers are predicted to serve 16.55 years less than White teachers.

Table 25

*Summary of Significant Ethnicities*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ | *Sig.* |
|---|---|---|---|---|
| Ethnicity | | | | |
| Asian | 63 | 5.11 | 20 | .022 |
| Black | 262 | 6.27 | 87 | .041 |
| Hispanic | 180 | 5.02 | 58 | <.001 |
| Native Hawaiian/Pacific Islander | 3 | 0.67 | 2 | .002 |

Note. The White ethnicity values are as follows: $f$ = 1,452, $\bar{X}_{ys}$ = 9.43, and No. > $\bar{X}_{ys}$ = 507.

### *Correlation of Removed Level 1 Variables*

As mentioned earlier, several variables were removed from the study because they could not be included in the final model. Their exclusion was due to several different factors: high multicollinearity, low tolerance, non-significance, or lack of support in the literature. However, I conducted a test of correlation with the dependent variable and I will discuss the results of this analysis.

*Non-Significant Correlations*. Of all the removed variables from the Level 1 analyses, only one of those variables was not found to be statistically significant. That variable was the number of places at which a teacher taught during his or her last year of employment. The returned significance value of this variable is $p = .684$ and barely has a positive correlation of $r = .009$. It is easy to see how this variable is not statistically significant due to its low representation within the data set and correlation with the dependent variable. Only 28 teachers taught at more than one school during their last year of employment and those teachers served, on average, 7.32 years, which is close to the average of 8.42 years of service for the whole data set.

*Positive Significant Correlations*. The following variables were found to be statistically significant and are positively correlated with the dependent variable: Florida non-public school years, Florida public school years, out-of-state non-public school years, out-of-state public school years, years of military service, years of service in school administration, years in current district, years in current assignment, total years of service outside of Florida, and total years of teaching. It is easy to see how these variables correlate when you consider what each of these variables represent. In many instances these removed variables almost completely correlated ($r = 1.00$) with the dependent variable or other independent variables.

I will start with the years of service in Florida public and non-public schools. Both of these removed variables returned a significance value of $p < .001$. The years of service within the Florida public schools heavily correlated ($r = 0.985$) and the years of service in Florida non-public schools also positively correlated ($r = 0.173$). This is easily understood considering the data set. The vast majority of the teachers ($f = 1{,}827$) taught in public schools and 176 teachers taught in charter schools. The high and low correlations of public and non-public years of service exist due to the high and low representation of both of these categories of teachers.

Next, I will discuss teachers who have years of service in out-of-state schools that are either public or non-public. Out-of-state public school teachers return a significance value of $p = .001$ and out-of-state non-public teachers return a significance value of $p = .013$. However, both of these values only barely positively correlate with the dependent variable. Again, this is due to the small representation of teachers within the final data set. There are 304 teachers who have out-of-state public school experience and 67 teachers who have out-of-state non-public experience within the data set. This means that 1,632 teachers within the data set have taught only within the Florida school system.

The next two correlations I will discuss are years of service in the military and years of service in school administration. Both military and administration years of service variables were found to be statistically significant with the dependent variable ($p = .016$ and $p = .003$, respectively). Again, both of these removed variables have low positive correlations, which is due to low representation in the data set. There are 65 teachers who served in the military and 26 teacher who served in school administration within the final data set. These numbers leave 1,912 teachers who did not serve in the military or within school administration.

Both years in current assignment and years in current district test as statistically significant with the dependent variable, with a significance value of $p < .001$ for both variables. Both of these variables are also highly positively correlated, with the dependent variable having a Pearson $r$ of .700 for years in current assignment and .908 for years in current district. This high correlation is believable, as the average years of service in a teacher's current assignment or district is 4.48 and 6.71 years, respectively.

The final two positively correlated variables are a teacher's total years of service outside of Florida and total years of teaching. Both variables were found to be statistically significant, with a significance value of $p < .001$. When looking at their correlations, a teacher's total years of service outside of Florida is barely correlated ($r = .090$) and a teacher's total years of teaching are highly correlated to the dependent variable ($r = .934$). Again, a low correlation was expected, since only 370 teachers (15.3% of the population) have years of service outside of Florida. A high correlation exists for a teacher's total years of teaching, because all 2,003 teachers' total years of teaching is a summation of their years from out-of-state and from within the Florida school system. A summary of all the correlated variables is seen in Table 26.

Table 26

*Summary of Correlated Variables*

| Independent Variable | *f* | $\bar{X}_{ys}$ | *r* | *Sig.* |
|---|---|---|---|---|
| No. Places Taught | 28 | 7.32 | .009 | .684 |
| Florida Non-Public School Years | 176 | 5.23 | .173 | <.001 |
| Florida Public School Years | 1,827 | 8.72 | .985 | <.001 |
| Out-of-State Non-Public School Years | 67 | 4.70 | .055 | .013 |
| Out-of-State Public School Years | 304 | 12.57 | .077 | .001 |
| Migration Count | 115 | 6.60 | –.046 | .041 |
| Military Years | 65 | 12.54 | .054 | .016 |
| Administration Years | 26 | 16.88 | .067 | .003 |
| Current District Years | | 6.71 | .908 | <.001 |
| Current Assignment Years | | 4.48 | .700 | <.001 |
| Total Years of Service Outside Florida | | 11.15 | .090 | <.001 |
| Total Years of Teaching | | 9.65 | .934 | <.001 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

*Negative Significant Correlations*. The migration count variable was found to be statistically significant ($p$ = .041) and was negatively correlated ($r$ = –.046) with the dependent variable. Of all the teachers found within the data set, 115 migrated between schools during the studied period, and the average professional longevity for these teachers is 6.60 years. Therefore, although this variable has low representation within the data set, the average years of service of those teachers who migrated between schools is below the average of the population.

### *Level 2 MLR Discussion*

Unlike the Level 1 analyses, which contained numerous independent variables, the Level 2 analysis for the study tested eight independent variables. Of the eight independent variables tested, four of them were found to be statistically significant. The following paragraphs address the reasons behind these outcomes.

*Level 2 Non-Significant Variables*. Of the eight independent variables in the Level 2 analysis, a school's average class size, town geographic location, and residential population density (Midsize/Distant and Small/Remote) were found to be statistically non-significant. First, it is not a surprise that the average class size is not statistically significant, due to Florida's laws on class sizes (FLDOE, 2003). Additionally, if the class size range of 0 – 5 student(s) is removed, the frequency distribution of the schools' average class size is almost normally distributed around the mean class size of 20.21 students. Table 27 contains a summary of the class size distribution. With the range of 0 – 5 students added in, the average class size is 15.15.

Table 27

*Summary of Average Class Size Ranges*

| Class Size Range | *f* | % Pop. |
|---|---|---|
| 0 – 5 Students | 503 | 25.11 |
| 6 – 10 Students | 15 | 0.75 |
| 11 – 15 Students | 40 | 2.00 |
| 16 – 20 Students | 729 | 36.40 |
| 21 – 25 Students | 687 | 34.30 |
| 26 – 30 Students | 27 | 1.35 |
| 31 – 35 Students | 0 | 0.00 |
| 36 – 40 Students | 2 | 0.09 |
| Total | 2003 | 100.00 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

### *Non-Significant Geographic Locations*

When testing the geographic location and residential population density these variables needed to be “dummy” coded in order to create categorical variables. Therefore, all geographic locations were compared to schools in the suburbs, and residential population density was compared to Large/Fringe schools, since these two categories represent the largest percentage of the population of schools, 48.3% and 62.4% respectively. When compared to suburban schools, schools located within townships were found to not be statistically significant. Again, this is very likely due to the fact there are only 114 (5.7%) instances of a school within a town in the data set, as schools within towns are not well represented in the population. However, teachers employed in town schools did serve on average 8.69 years, which is above the population’s average years of service of 8.42 years and is even closer to the average of 8.90 years for teachers in suburban schools.

*Non-Significant Residential Population Densities*

The final two variables that were found to not be statistically significant are schools in residential population densities that are Midsize/Distant and Small/Remote. Again, these variables were compared to Large/Fringe schools. Neither of these variables is statistically significant most likely because they have low representation in the data set. Midsize/Distant schools fared better, with 487 schools, but Small/Remote schools were represented only 267 times. However, these numbers are an actual reflection of human population densities. Most individuals reside in Large/Fringe areas near population centers. As one moves away from population centers, the population continues to decrease and therefore requires fewer schools. Another reason why neither of these variables tested as statistically significant could be because the average years of service for Midsize/Distant and Small/Remote teachers is 8.51 and 8.86 years, respectively. These values are rather close to the Large/Fringe teacher's average professional longevity of 8.29 years of service. A summary of this information is found in Table 28.

Table 28

*Summary of Non-Significant Location Variables*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | % Pop. | *Sig.* |
|---|---|---|---|---|
| Geographic Location | | | | |
| Town | 304 | 8.69 | 5.69 | .381 |
| Residential Population Density | | | | |
| Midsize/Distant | 487 | 8.51 | 24.31 | .201 |
| Small/Remote | 267 | 8.86 | 13.33 | .135 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools). The Suburb geographic location values are as follows: $f$ = 967, $\bar{X}_{ys}$ = 8.90, and % Pop. = 48.28%. The Large/Fringe residential population density values are as follows: $f$ = 1,249, $\bar{X}_{ys}$ = 8.29, and % Pop. = 62.36%.

*Level 2 Significant Variables*. The following four variables were found to be statistically significant in the Level 2 school analysis: Charter Status, SES, and City and Rural schools. I was a little surprised by the fact the Charter Status of a school is statistically significant. Within the state of Florida, charter schools have a reputation of being high-quality schools where teachers want to teach. However, the Charter Status variable showed a significance value of $p < .001$. Additionally, a Florida high school science teacher who teaches at a charter school is predicted to serve 3.13 years less than a high school science teacher in a traditional public school. These values are not surprising when reviewing the data. Although charter school instructors have low representation in the data set (176, 8.79%), charter school instructors work on average 5.24 years compared to public school teachers who work on average 8.72 years. Table 29 contains a summary of the charter and public school teachers' data.

Table 29

*Summary of Charter and Public School Teacher Data*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | % Pop. | *Sig.* |
|---|---|---|---|---|
| Charter Status | | | | <.001 |
| Charter | 176 | 5.23 | 8.79 | |
| Public | 1,827 | 8.72 | 91.21 | |
| Total | 2003 | | 100.00 | |

Note. Dependent Variable: Profession Longevity (total years of service in Florida schools).

*SES as a Significant Predictor*

The SES of a school was found to be a statistically significant predictor, with a significance value of $p = .009$. It was also determined that high school science teachers in Florida are expected to serve 0.03 years fewer for every unit increase in SES. Extrapolating this we would then expect to find that a teacher who works at a school that has 100% of its 9–12 graders receiving free/reduced lunches is predicted to serve three years fewer than a high school science teacher who serves in a school with zero percent SES. Although a zero percent SES is theoretically impossible, this puts into perspective the fact that SES can be a predictor of a high school science teacher's professional longevity. This is not surprising, given how the literature shows that schools which have high SES, such as urban schools, are difficult to staff (Currie & Thomas, 2001; Klassen & Chiu, 2011; Shen et al., 2012). However, this trend is also seen in the data. Once a school's average SES exceeds 30%, the average professional longevity of teachers begins to decline. A summary of schools' SES data is in Table 30.

Table 30

*Summary of School SES Distribution*

| Independent Variable | *f* | $\bar{X}_{ys}$ | % Pop. | *Sig.* |
|---|---|---|---|---|
| SES Category | | | | .009 |
| 0% – 10% | 80 | 4.83 | 3.99 | |
| 11% – 20% | 89 | 9.24 | 4.44 | |
| 21% – 30% | 203 | 10.02 | 10.13 | |
| 31% – 40% | 313 | 9.34 | 15.63 | |
| 41% – 50% | 351 | 9.58 | 17.52 | |
| 51% – 60% | 364 | 8.41 | 18.17 | |
| 61% – 70% | 282 | 7.83 | 14.08 | |
| 71% – 80% | 206 | 7.02 | 10.28 | |
| 81% – 90% | 83 | 5.53 | 4.14 | |
| 91 – 100% | 32 | 4.47 | 1.60 | |
| Total | 2003 | | 100.00 | |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

### *Geographic Location as a Significant Predictor*

Both city and rural schools were found to be statistically significant predictors of a Florida high school science teacher's professional longevity, having significance values of $p$ = .022 and $p$ = .048 respectively. Again, both of these variables were compared to teachers serving in suburban schools. Based upon the statistical analysis, a teacher in a city school is predicted to serve 1.41 years less than a teacher in a suburban school. Additionally, a teacher who teaches in a rural school is predicted to teach 1.23 years less than a teacher in a suburban school. When examining the data, it is easy to understand the reasons behind these results. First, both of these variables are represented less in the data set than teachers in suburban schools (967 teachers). There are 586 teachers in city schools and 336 teachers in rural schools. Additionally, both teachers in city (7.96 years) and rural (7.71 years) schools serve on average less than teachers in suburban schools. Table 31 contains a summary of the geographic location's data.

Table 31

*Summary of Significant Geographic Locations*

| Independent Variable | *f* | $\bar{X}_{ys}$ | % Pop. | *Sig.* |
|---|---|---|---|---|
| Geographic Location | | | | |
| City | 586 | 7.96 | 29.26 | .022 |
| Rural | 336 | 7.71 | 16.77 | .048 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools). The Suburb geographic location values are as follows: $f$ = 967, $\bar{X}_{ys}$ = 8.90, and % Pop. = 48.28%.

*Level 3 MLR Discussion*

The two Level 3 (district) independent variables I studied are a school district's average SES measured by the percentage of free and reduced lunches served to 9–12 graders, and the average spending per 9–12 grade student within the district. At the conclusion of the analysis, a district's average SES was found to be statistically significant, with a significance value of $p$ < .001, and a district's average spending was found to not be statistically significant ($p$ = .187). The following paragraphs detail my suggested explanation for these results.

*Level 3 Non-Significant Variables*. The average district spending for 9–12 grade students was found to be statistically non-significant. I was surprised to see this, as the literature explains that average spending often affects a teacher's professional longevity (Jimenez-Castellanos, 2010; Watlington et al. 2010). However, in reviewing the data, the results become understandable. The data for a district's average SES is heavily skewed right and is not normally distributed around the mean. The average district spending per 9–12 grade pupil is $7,189. However, the near majority (49.7%) of the districts is below the overall mean and spends $5,000 or less on each pupil. Additionally, in looking at the average professional longevity for each spending category, the average years of service do not fluctuate much from the overall population mean of 8.42 years of service. The only exceptions to this are school districts that spend $20,001 or more on their 9–12 grade pupils. However, these districts are represented only 86 times in the data set, which is 4.29% of the population. Therefore, district spending should be expected to not be significant. A summary of the district spending data is in Table 32.

*Level 3 Significant Variables*. It is no surprise that the average district SES tests as statistically significant, given that the literature concludes it is often a significant predictor of a teacher's professional longevity (Achinstein et al., 2010; Adamson & Darling-Hammond, 2012; Reininger, 2012). From the analysis, it was seen that Florida high school science teachers are expected to serve 0.09 years fewer for every unit increase of SES. Again, extrapolating this would mean that a teacher who works in a district that has 100% of its 9–12 graders receiving free/reduced lunches is predicted to

Table 32

*Summary of Non-Significant District Spending Data*

| Independent Variable | *f* | $\bar{X}_{ys}$ | % Pop. | *Sig.* |
|---|---|---|---|---|
| District Spending Category | | | | .187 |
| $0 – $5,000 | 996 | 8.66 | 49.73 | |
| $5,001 – $10,000 | 368 | 9.15 | 18.37 | |
| $10,001 – $15,000 | 353 | 7.99 | 17.62 | |
| $15,001 – $20,000 | 200 | 8.23 | 9.99 | |
| $20,001 – $25,000 | 86 | 4.62 | 4.29 | |
| Total | 2003 | | 100.00 | |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

serve nine years fewer than a high school science teacher who serves in a school district with zero percent SES. However, I believe I discovered why this occurred in this analysis. The average district SES is 56.59% and the data seem to be somewhat normally distributed around the mean. However, once the average SES for a district exceeds 40%, the average professional longevity for a science teacher begins to decrease and continues to decrease until SES reaches its maximum. Therefore, as SES increases, the professional longevity of a high school science teacher in Florida decreases. Table 33 summarizes the district's SES data.

*HMR Discussion*

The HMR analysis of this study tests only independent variables that are statistically significant in the previous Level 1, Level 2, and Level 3 models. This entry of only statistically significant variables is appropriate because most often variables in higher levels do not affect the significance of variables in lower levels; they typically affect only a variable's final *B* value (Field, 2009). In other words, if the variable is not initially significant, there is little chance a HMR will make it statistically significant.

There are three steps (blocks) to the HMR since the independent variables tested are from three different levels within the realm of education.

Table 33

*Summary of District SES Distribution*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | % Pop. | *Sig.* |
|---|---|---|---|---|
| SES Category | | | | <.001 |
| 0% – 10% | 0 | | 0.00 | |
| 11% – 20% | 0 | | 0.00 | |
| 21% – 30% | 37 | 9.22 | 1.85 | |
| 31% – 40% | 47 | 13.11 | 2.35 | |
| 41% – 50% | 416 | 9.06 | 20.77 | |
| 51% – 60% | 694 | 8.76 | 34.65 | |
| 61% – 70% | 621 | 8.03 | 31.00 | |
| 71% – 80% | 171 | 5.64 | 8.54 | |
| 81% – 90% | 13 | 6.23 | 0.65 | |
| 91 – 100% | 4 | 4.25 | 0.20 | |
| Total | 2003 | | 100.00 | |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

Before I discuss the results of the final analysis, I feel I must summarize how each independent *B* value changed throughout the analysis. As expected with HMR (Field, 2009), all independent variables, with the exception of salary, essentially remained constant or decreased when additional levels were added to the HMR. Additionally, the majority of independent variables' significant values increased as levels were added to the HMR. A summary of the changes in the variables' *B* values and significance is found in Table 34 and Table 35 respectively. Although there are three steps to the HMR, the following paragraphs will discuss only the results of the final step of the HMR.

*HMR Non-Significant Variables*. As seen in Table 35, the following variables were not statistically significant in the final model: a teacher's ethnicity (Asian and

Table 34

*Summary of Changes in Variables' B Values*

| Independent Variable | *B* Step 1 | Step 2 | Step 3 |
|---|---|---|---|
| Constant | –11.65 | –10.45 | –6.78 |
| Age | 0.42 | 0.42 | 0.42 |
| Salary | 7.78 E–5 | 7.79 E–5 | 8.16 E–5 |
| Earned Degree | | | |
| Baccalaureate vs. Unknown | –4.41 | –4.37 | –3.91 |
| Baccalaureate vs. Associate | –5.69 | –6.03 | –5.45 |
| Baccalaureate vs. Doctorate | –3.79 | –3.79 | –3.79 |
| Ethnicity | | | |
| White vs. Asian | –2.14 | –1.92 | –1.67 |
| White vs. Black | –0.97 | –0.58 | –0.59 |
| White vs. Hispanic | –2.22 | –1.91 | –1.67 |
| White vs. Native Hawaiian | –11.75 | –11.66 | –10.82 |
| Charter Status | | –2.18 | –2.03 |
| School SES | | –0.02 | 0.001 |
| Geographic Location | | | |
| Suburb vs. City | | 0.11 | –0.09 |
| Suburb vs. Rural | | –0.61 | –0.56 |
| District SES | | | –0.09 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

Black), a school's SES, and a school's geographic location (city or rural). In looking at the variables that were not statistically significant in the final model, it appears that predictors on higher levels of the HMR changed the significance of lower level predictors. In the following paragraphs I will discuss why I believe this occurred.

*Non-Significant Ethnicities in HMR*

In order to understand why teachers of Asian and Black ethnicity were not statistically significant predictors of professional longevity in the final model, I looked at significant predictors in the second level of the model. In the second level of the model,

Table 35

*Summary of Changes in Variable's Significance Values*

| Independent Variable | *Sig.* Step 1 | Step 2 | Step 3 |
|---|---|---|---|
| Constant | <.001 | <.001 | <.001 |
| Age | <.001 | <.001 | <.001 |
| Salary | <.001 | <.001 | <.001 |
| Earned Degree | | | |
| Baccalaureate vs. Unknown | <.001 | <.001 | <.001 |
| Baccalaureate vs. Associate | <.001 | <.001 | <.001 |
| Baccalaureate vs. Doctorate | <.001 | <.001 | <.001 |
| Ethnicity | | | |
| White vs. Asian | .025 | .044 | .080 |
| White vs. Black | .054 | .260 | .247 |
| White vs. Hispanic | <.001 | .001 | .005 |
| White vs. Native Hawaiian | .006 | .006 | .011 |
| Charter Status | | <.001 | .001 |
| School SES | | .017 | .956 |
| Geographic Location | | | |
| Suburb vs. City | | .770 | .809 |
| Suburb vs. Rural | | .191 | .224 |
| District SES | | | <.001 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

only a school's charter status was found to be a statistically significant predictor. It is also important to recall that all ethnicities were compared to White ethnicity. In comparing the distribution of years of service, six Asian teachers taught in charter schools and have an average professional longevity of 6.00 years. Additionally, Asian teachers make up only 4.55% of the charter teacher population. However, the average professional longevity for Asian teachers is very close to the average professional longevity for White teachers in charter schools (6.36 years). Therefore, it is easy to see why Asian ethnicity is not statistically significant in the final step of the HMR model. This is further explained by the fact that Asian teachers have low representation in charter schools. Thus, an Asian teacher's professional longevity is not statistically different from a White teacher's professional longevity.

Black teachers are also statistically non-significant due to low representation (221, 23.30%) within the charter schools compared to teachers who are White (1,353, 56.25%). However, what is puzzling is the fact the average professional longevity of Black teachers (4.51 years) is less than the average professional longevity of White teachers (6.36 years). The reason for the non-significance could be explained by the fact the average years of service for these two ethnicities are on opposite sides of the mean professional longevity for all charter school instructors (5.23 years). Thus, there is no statistical difference between the years of service of a Black or White teacher. A summary of this information is found in Table 36.

Table 36

*Summary of Non-Significant HMR Ethnicities*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ | % Pop. |
|---|---|---|---|---|
| Charter School Ethnicities | | | | |
| Asian | 8 | 6.00 | 2 | 4.55 |
| Black | 41 | 4.51 | 20 | 23.30 |
| Public School Ethnicities | | | | |
| Asian | 55 | 4.98 | 20 | 3.01 |
| Black | 221 | 6.60 | 80 | 12.10 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools). The White ethnicity values are as follows: Charter Schools – $f$ = 99, $\bar{X}_{ys}$ = 6.36, and No. > $\bar{X}_{ys}$ = 29; and Public Schools – $f$ = 1,353, $\bar{X}_{ys}$ = 9.66, and No. > $\bar{X}_{ys}$ = 485.

*Non-Significant School SES in HMR*

A school's SES was found to be statistically non-significant in the final HMR model ($p$ = .956). Since only factors in higher levels can affect lower level factors, a district's SES must influence the significance value of a school's SES. In the second step of the HMR analysis, the school's SES has a significance of $p$ = .017. However, this value reaches nearly 1.00 in the third step of the HMR model. Why does this occur? This jump in significance value occurs because schools are nested within districts. The district's SES is an average of each school's SES found within the district. In other words, it is an average measure of the same value. Therefore, it would make sense that the district SES would override the significance of school SES.

*Non-Significant Geographic Locations in HMR*

Both of the final geographic locations (city and rural) were found to be statistically non-significant ($p$ = .809 and $p$ = .224 respectively). Again, since these are Level 2 school variables, the only variable that could affect these two independent variables is the Level 3 District SES variable. As a reminder, both of these geographic locations were compared to suburban schools. How does a district's SES affect the geographic location's original significance? The average years of service for teachers in city and rural schools are nearly identical (7.96 and 7.72 years respectively). When comparing these values to the average years of service of teachers in suburban schools (8.90 years), it is easy to see that city and rural schools were initially different from suburban schools. However, when reviewing the average District SES for each of these categories, it becomes clear that the geographic locations are no longer significant. The average District SES for teachers in city schools is 54.30%, 57.77% for teachers in rural schools, and 57.22% for teachers in suburban schools. Given the closeness in the overall District SES average, it is clear that the District SES causes the geographic locations to be statistically non-significant. Table 37 contains a summary of this data. Importantly, when considering a district's SES, there is no statistical difference between the years of service of teachers in city or rural schools when compared to teachers in suburban schools.

Table 37

*Summary of Non-Significant Geographic Locations in HMR*

| Independent Variable | *f* | $\bar{X}_{ys}$ | No. > $\bar{X}_{ys}$ | $\overline{\text{SES}}$ | *Sig.* |
|---|---|---|---|---|---|
| Geographic Location | | | | | |
| City | 586 | 7.96 | 212 | 54.30 | .809 |
| Rural | 336 | 7.72 | 113 | 57.77 | .224 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools). The Suburban school values are as follows: *f* = 967, $\bar{X}_{ys}$ = 8.90, and No. > $\bar{X}_{ys}$ = 349.

*HMR Significant Variables*. Within the final HMR model the following variables were found to be statistically significant: a teacher's age; salary; earned degree (unknown, associate, and doctorate); ethnicity (Hispanic and Native Hawaiian/Pacific Islander); a school's charter status; and a district's SES. Considering the reviewed literature, the finding that these variables are statistically significant predictors of a teacher's professional longevity is not surprising (Adamson & Darling-Hammond, 2012; Carruthers, 2012; Gilpin, 2011; Hancock & Scherff, 2010; Harris and Adams, 2007; Hoxby, 2002; Hughes, 2012; Imazeki, 2005; Ingersoll & Perda, 2010; Malloy & Wohlstetter, 2003; Skaalvik and Skaalvik, 2011). The remaining paragraphs of this discussion section will focus on how I believe these variables are significant predictors of a teacher's professional longevity.

### *Age as a Significant Predictor in HMR*

What I find intriguing about the age of a teacher as it relates to this study is that its *B* value remains constant throughout each step of the HMR. Throughout these steps, the *B* value remains 0.42, indicating that for every unit increase in a teacher's age, the predicted years of service of a teacher increases by 0.42 years. This should not be surprising given the fact that as a teacher ages, as long as he or she is employed, professional longevity will continue to increase. However, as previously seen in Table 22 earlier in this chapter, there must come a point where this *B* value is no longer true, as most teachers retire or leave the education profession early (Ingersoll & Perda, 2010). However, for this study of Florida high school science teachers, the age of a teacher is a statistically significant predictor of professional longevity. Additionally, for this study, the age of a teacher positively influences the professional longevity of science teachers.

### *Salary as a Significant Predictor in HMR*

In reviewing what occurs with the *B* value of a teacher's salary throughout the HMR, it is intriguing to see a large increase in the *B* value between the second and third steps of the analysis. This suggests that District SES affects the influence of a teacher's professional longevity via his or her salary. In dividing the District SES into 10 categories, the answer becomes clear. In general, as a district's SES increases, so does a teacher's average salary, with the exception of districts with SES between 40% and 60%. This would follow the reviewed literature in that districts with higher SES are harder to staff and therefore often use salary to keep teachers in these districts (Achinstein et al., 2010; Adamson & Darling-Hammond, 2012; Reininger, 2012).

However, although higher salary is given in these higher SES districts, the average professional longevity of teachers within the SES categories continues to decrease once district SES is above 40%. Table 38 summarizes these findings. Based on the findings of this study, for every unit increase in salary, a high school science teacher's professional longevity is predicted to increase by 8.16 E–5 years. Since a teacher's salary is a significant predictor of a teacher's years of service, this means that for every dollar increase in pay, Florida should expect a teacher to stay longer. However, it will take a raise of $100,000 in order to get a teacher to stay 8.16 additional years, according to these findings.

Table 38

*Summary of District SES Influence on Salary*

| Independent Variable | *f* | $\bar{X}_{ys}$ | % Pop. | Avg. Salary | *Sig.* |
|---|---|---|---|---|---|
| SES Category | | | | | <.001 |
| 0% – 10% | 0 | | 0.00 | | |
| 11% – 20% | 0 | | 0.00 | | |
| 21% – 30% | 37 | 9.22 | 1.85 | $33,290 | |
| 31% – 40% | 47 | 13.11 | 2.35 | $34,211 | |
| 41% – 50% | 416 | 9.06 | 20.77 | $27,534 | |
| 51% – 60% | 694 | 8.76 | 34.65 | $27,333 | |
| 61% – 70% | 621 | 8.03 | 31.00 | $36,767 | |
| 71% – 80% | 171 | 5.64 | 8.54 | $31,657 | |
| 81% – 90% | 13 | 6.23 | 0.65 | $35,697 | |
| 91 – 100% | 4 | 4.25 | 0.20 | $40,540 | |
| Total | 2003 | | 100.00 | | |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

### *Earned Degree as a Significant Predictor in HMR*

The three degrees that test as statistically significant predictors of a teacher's professional longevity are an unknown, associate, and doctorate degree. Again, each degree is compared to teachers whose highest degree is a baccalaureate. In looking at the data, I want to first draw attention to the fact the *B* value (–3.79) of the Baccalaureate vs. Doctorate variable never changed throughout the steps of the HMR analysis. It appears that no variables in higher levels influenced the doctoral degree variable. Therefore, this would seem to confirm what Hughes (2012) stated in his study, that higher degrees do not guarantee that teachers will stay. Based upon the findings of this study, a teacher whose highest earned degree is a doctorate is predicted to serve 3.79 years less than a teacher whose highest degree is a baccalaureate.

Unlike the doctorate degree's *B* value, the *B* values for teachers whose degree is unknown or whose highest degree is an associate, experience an overall decrease between the first and last steps of the HMR. Since the earned degree of a teacher is a Level 1 variable, I must consider the influence a school's charter status and district's SES may have on these earned degrees. I doubt that the charter status of a school, although statistically significant in the final model, has much influence over either of these two degrees. The reason is that few of an unknown or associate degree are represented in charter schools (1 and 7 teacher(s) respectively). Therefore, I believe that the district's SES is influencing the unknown and associate degree variables. The reason is that the average district SES for an unknown degree is 61.21% and for an associate degree it is 60.10%. Therefore, both of these degrees, on average, supply workers to higher SES districts. This could be due to the fact that since higher SES districts have a more difficult time hiring teachers (Adamson & Darling-Hammond, 2012), these districts may accept lower-level degree holders in order to fill open positions. A summary of the district SES and charter status data is in Table 39.

Table 39

*Summary of SES and Charter Status Influence on Earned Degree*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | % Pop. | $\overline{\text{SES}}$ |
|---|---|---|---|---|
| Charter School Degree | | | | |
| Unknown | 7 | 1.71 | 0.35 | 59.00 |
| Associate | 1 | 3.00 | 0.05 | 63.00 |
| Public School Degree | | | | |
| Unknown | 51 | 4.10 | 2.55 | 61.51 |
| Associate | 28 | 3.89 | 1.40 | 60.00 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

Another thing to remember is that both of these degrees tested as statistically significant since the first step of the HMR analysis. Therefore, it is only the quantity by which these variables influence the professional longevity of a teacher that fluctuates with higher-level independent variables. Based upon the findings of this study, when compared to a teacher whose highest degree is a baccalaureate, a teacher whose degree is unknown is predicted to work 3.91 years less. For a teacher whose highest degree is an associate, they are predicted to work 5.45 years less than a teacher whose highest degree is a baccalaureate.

### *Ethnicity as a Significant Predictor in HMR*

I am surprised that two out of the seven ethnicities tested were statistically significant in the final HMR model. The two ethnicities that were found to be statistically significant are teachers who are Hispanic ($p$ = .005) and Native Hawaiian/Pacific Islander ($p$ = .011). Based upon the data, however, it is easy to see how these variables tested as significant predictors of a teacher's professional longevity. According to the data, there are 180 Hispanic teachers and 3 Native Hawaiian/Pacific Islander teachers, and both groups have low average professional longevity (5.02 and 0.67 years respectively).

Therefore, due to lack of representation in the data set and overall low average professional longevity, it is not surprising that both ethnicities were found to be statistically significant. What is also important to remember is that both of these ethnicities were compared to teachers who are White, in order to create categorical variables. In looking at the representation (1,452) and average professional longevity (9.43) of teachers who are White, it is also clear to see why these ethnicities are significant in the final HMR model. Both the representation and average professional longevity of these two ethnicities are different from teachers who are White.

It is important to remember that based upon the literature there are typically more variables that influence the ethnicity of a teacher when predicting their professional longevity (Ingersoll & May, 2011; Scheopner, 2010), some that surely are not included in this study. Based upon the variables in this HMR, the results of this study predict that teachers who are Hispanic or Native Hawaiian/Pacific Islander will have professional longevity 1.67 and 10.82 years shorter, respectively, than a White teacher. The data for these findings were summarized previously, in Table 25.

### *Charter Status as a Significant Predictor in HMR*

The only Level 2 variable, which tested as statistically significant, was the charter status of a school. Between the second and third steps of the HMR analysis the *B* value of this independent variable did not change much (–2.18 to –2.03, respectively). Therefore, it does not appear that a district's SES has much influence on a school's charter status, according to the model. In looking at the average district SES for both charter (60.07%) and public (56.26%) schools there is not much difference between the two. It is also important to remember that the charter status of a school was found to be statistically significant before the third step of the HMR analysis. When comparing the average years of service between teachers in charter and public schools, teachers in charter schools have a much lower average professional longevity compared to public school teachers (5.23 and 8.72 years respectively). A summary of the districts' SES influence on charter and public schools is found in Table 40. Therefore, based upon the findings of this study, the charter status of a school is a predictor of a teacher's professional longevity. A Florida high school science teacher who teaches at a charter school is expected to teach 2.03 years less than a high school science teacher at a public school.

Table 40

*Summary of District SES Influence on Charter Status*

| Independent Variable | $f$ | $\bar{X}_{ys}$ | $\overline{\text{SES}}$ |
|---|---|---|---|
| Charter Status | | | |
| Charter Schools | 176 | 5.23 | 60.07 |
| Public Schools | 1,827 | 8.72 | 56.26 |

Note. Dependent Variable: Professional Longevity (total years of service in Florida schools).

*District SES as a Significant Predictor in HMR*

The final variable that was found to be statistically significant in the third step of the HMR model is District SES. A school district's SES has a significance value of $p < .001$. Since this variable is in Level 3, the last level, and its *B* value cannot be influenced by any independent variables in lower levels (Field, 2009), the discussion concerning why this variable is significant appeared previously in this chapter. Based on the results of this study, it is predicted that a high school science teacher will serve 0.09 years less for every unit increase in a school district's SES. With extrapolation, this means that a teacher teaching in a school district with 100% SES is predicted to teach 9 years less than a teacher who teaches in a school district with zero SES.

*Summary of Discussion*

It is clear that if all other factors are held constant the following independent variables are statistically significant: a teacher's age; salary; earned degree (unknown, associate, and doctorate); ethnicity (Hispanic and Native Hawaiian/Pacific Islander); a school's charter status; and a district's SES. A teacher's earned degree (unknown, associate, and doctorate), ethnicity (Hispanic and Native Hawaiian/Pacific Islander), a school's charter status, and a district's SES all negatively influence the professional longevity of high school science teachers in Florida. Only a teacher's age and salary have a positive influence on a teacher's professional longevity. A teacher's ethnicity (Asian and Black), a school's geographic location (city and rural), and SES were found to be statistically non-significant.

## Conclusions

Every year Florida loses high school science teachers. Oftentimes these teachers are well qualified (Ingersoll & Smith, 2003a), but due to circumstances either in their lives or their work, they often leave the teaching profession. This study is an attempt to determine what factors influence the professional longevity of high school science teachers in Florida. I know the FLDOE is committed to retaining high-quality teachers in order to improve the Florida education system. From the previously conducted and discussed study, and keeping within the aforementioned delimitations, limitations, and assumptions mentioned in the first chapter, I offer the following conclusions:

1. Generalizability – Although there are a few instances of assumptions not being met within the various analyses (see Appendices D, E, F, and G), the primary culprit of the violation of the MLR and HMR assumptions is the non-

normal distribution of the professional longevity variable. Therefore, I am reasonably confident that similar results could be achieved for different academic disciplines within Florida. Similar results in other states could be possible as well. However, each state has different requirements of their teachers and may not collect data using the same methods Florida uses.

2. Age – This study illustrates that age has a positive influence on a teacher's professional longevity. This could be due to the fact that with more age a teacher gains more experience and therefore is more likely to remain in the education profession.
3. Sex – A teacher's sex is not a statistically significant predictor of a high school science teacher's professional longevity. That is, male and female teachers should be expected to have similar professional longevity.
4. Salary – A teacher's salary has a positive influence on the professional longevity of a high school science teacher in Florida. Therefore, the more a teacher is paid, the more likely it is that he or she will remain in the teaching profession. However, the influence of salary on professional longevity is minute.
5. Earned Degree – All the remaining degrees in the final model were shown to negatively influence a teacher's professional longevity. Therefore, advanced degrees do not guarantee that a teacher will remain within the education system.
6. Ethnicity – Most of the ethnicities tested were shown to not be statistically significant predictors of a science teacher's professional longevity. Although

two ethnicities tested as statistically significant, neither was well represented in the data set.

7. Years in Current Assignment – This variable is highly correlated with the dependent variable. This means that the professional longevity of high school science teachers is similar to the number of years of service in their current assignments. This shows that science teachers in Florida do not have their assignments changed very often.
8. Years in Current District – This variable is highly correlated with the dependent variable. This means that the professional longevity of Florida high school science teachers is similar to the number of years of service in their current school districts. Thus, it is clear that high school science teachers are not often moving between school districts.
9. Migration Count – The migration count of a high school science teacher is negatively correlated with the dependent variable. Therefore, when a science teacher migrates between different schools there is a likelihood the teacher's professional longevity will decrease.
10. Average Class Size – The average class size of a school was found to not be statistically significant. Therefore, the size of a class should not influence the professional longevity of a high school science teacher in Florida.
11. Charter Status – Charter schools are a statistically negative predictor of a teacher's professional longevity. That is, it appears that high school science teachers are staying longer in traditional public schools than they are in charter schools.

12. School SES – Although a school's SES (percentage of free and reduced lunches served) is not a statistically significant predictor of professional longevity in the final model, it does have a negative influence. Indeed, it appears a school's SES is influential in predicting the professional longevity of a high school science teacher in Florida when not considering the school district's SES.
13. Geographic Location – Based upon the results of this study, a school's geographic location (city, suburb, town, or rural) was found to not be a statistically significant predictor of a Florida high school science teacher's professional longevity.
14. Residential Population Density – Based on the results of this study, a school's residential population density (large/fringe, mid-size/distant, or small/remote) is not a statistically significant predictor of a Florida high school science teacher's professional longevity.
15. District SES – Based on the results of this study, a district's SES (district average percentage of free and reduced lunches served) seems to have a negative influence on the professional longevity of a high school science teacher. That is, school districts with higher average SES seem to experience difficulties in retaining their staff.
16. Average Spending – In this study the average district spending did not influence the professional longevity of a high school science teacher. Thus, spending more money per pupil does not guarantee that a school district will be able to retain its high school science teachers.

## Implications

It must be remembered that the generalizability of this study is in question due to the nature of the collected data (see Appendices D, E, F, and G). However, the findings of this study should not be ignored, as such findings apply to high school science teachers in the Florida school system, whose numbers have not grown with student population increases. Moreover, this study has implications for other populations of teachers (social studies, English, mathematics) in the state.

By heeding the results of this study, Florida may potentially be able to retain superior high school science teachers. Recently, the Florida education system has not performed well in national testing in the sciences (U.S. Department of Education, 2012). However, if the conclusions I drew from this study, or others, actively target the retention of science teachers, Florida's science programs could begin to see a sense of stability that comes from modest teacher turnover. Florida's students could once again compete on a national level with standardized testing and Florida's science programs could gain funding and enjoy growth.

However, if these conclusions are rejected or no new initiatives are enacted in the state, Florida will very likely continue on the same paths it has traveled for nearly the last decade. These paths have resulted in low standardized test scores, redesigned and ultimately scrapped science FCATs, and little scientific achievement by students. There is no silver bullet to stop science teacher attrition. Science teachers will always retire and some teachers will always leave the school system. However, schools can actively target science teachers in order see how they feel about teaching in Florida in an effort to retain them.

## Recommendations and Suggestions for Future Studies

In order to keep researching the professional longevity of high school science teachers and to disseminate the results of this study, I make the following recommendations and suggestions for future studies:

1. A teacher needs to be paid what he or she is worth. Florida has set levels of salary based on degrees and additional responsibilities. However, since a teacher's salary has a positive influence on the professional longevity of a high school science teacher, Florida should consider alternative metrics (pathways) to determine the salary of a teacher, in order to keep well-qualified high school science teachers.
2. Although Florida should hire teachers who are qualified by degree, the state should not place so much emphasis on a teacher's degree that a teacher feels he or she *must* earn a higher degree. This seems true given the fact that all of the remaining degrees in the final model were found to negatively influence a teacher's professional longevity. Perhaps one way to decrease the feeling that a teacher needs to earn a higher degree is to adopt new salary metrics, which reduce the effect of a teacher's degree or certification on his or her salary. In other words, provide multiple pathways for teachers to earn higher salaries.
3. Florida should consider examining the daily operations and/or teacher attitudes at charter schools. Although newer than traditional public schools, charter schools are widely considered by the public to be a "better" alternative to many public schools. However, it appears that high school science teachers are staying longer in traditional public schools than they are in charter

schools. If high school science teachers continue to leave charter schools so soon, then science programs at these schools surely will suffer due to high teacher turnover.

4. Florida should consider examining school districts that have high SES (percentage of free and reduce lunches served). Based on the results of this study, a district's SES negatively predicts the professional longevity of a high school science teacher. Therefore, Florida should examine how to reduce the average district SES (percentage of free and reduced lunches) in poorer districts. Although the SES of a district is based on the percentage of free and reduced lunches served because of household poverty levels, the state of Florida should target districts of high SES with new initiatives and opportunities that assist families in getting "back on their feet" financially so that they do not have to depend on free or reduced lunches for their children.
5. Since the average district spending on students is not a statistically significant predictor of a teacher's professional longevity, Florida school districts should review their spending per pupil to see if funds can be saved or redirected to other areas of the district's budget.
6. The design of this study assumes that all teachers in all schools in all districts are the same, because of the exploratory nature of the MLR and HMR. This assumption is seen in the fact that the majority of the variance is explained in the first step of the HMR analysis ($R_1^2$ = .433), and the remaining steps change the $R^2$ values very little ($R_2^2$ = .441 and $R_3^2$ = .446). However, it is recommended for future research that this study be conducted in a hierarchical

linear modeling fashion, with structural equation modeling, in order to determine the differences, if any, between teachers, schools, and districts, and to see how the predictors in this study change.

7. Since the generalizability of this study is in question, I recommend that this study be conducted with high school science teachers in another state in order to see if similar results emerge.
8. Again, since the generalizability of this study is in question, I recommend that this study be conducted with teachers of different academic disciplines within the state of Florida to see if similar results emerge.
9. One area, which was not explored in this study, due to a late redesign in methodology, was differences in the professional longevity of first-career and second-career high school science teachers. Therefore, I recommend that this study be repeated and that the researcher add a variable to determine if first-career high school science teachers (those with degrees in science education) have professional longevity which exceeds or is less than that of second-career high school science teachers (those with degrees in science, technology, or engineering not focused in education or pedagogy).
10. Another area not covered by this study was a dual direction of causality. This one-way prescriptive study focused on factors, which predict the professional longevity of a high school science teacher without considering what factors a teacher already gained coming into the school system. Therefore, it is recommended that future research be conducted to determine if teachers, who already gained some of these factors, are either placed or selected specifically

where they teach within the school system. Therefore, does their placement in the school system influence how long they remain in the science education profession?

## Concluding Remarks

In conclusion, the results of this study demonstrate that a high school science teacher's professional longevity can be predicted by using factors such as a teacher's age, salary, earned degree, a school's charter status, and a school district's SES. It should be noted that there may exist other variables not included in this study that are also statistically significant influences on the professional longevity of a high school science teacher in Florida. The study of a teacher's professional longevity is never an entirely straightforward endeavor. It is extremely complex in nature. However, complexity should not stop future researchers from continuing to explore this important area of research. By continuing to pursue the answers and solutions associated with the professional longevity of teachers, researchers should be able to successfully combat and perhaps even turn the tide of rising teacher attrition.

APPENDIX A – IRB Approval Letter

Initial Approval Letter

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI.

**INSTITUTIONAL REVIEW BOARD**
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

**NOTICE OF COMMITTEE ACTION**

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 15040201
PROJECT TITLE: A Quantitative Analysis of Factors Affecting the Professional Longevity of Public High School Science Teachers in Florida
PROJECT TYPE: New Project
RESEARCHER(S): James A. Ridgley, Jr
COLLEGE/DIVISION: College of Science and Technology
DEPARTMENT: Center for Science and Math Education
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 05/05/2015 to 05/04/2016
**Lawrence A. Hosman, Ph.D.**
**Institutional Review Board**

Renewal Letter

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

**INSTITUTIONAL REVIEW BOARD**
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

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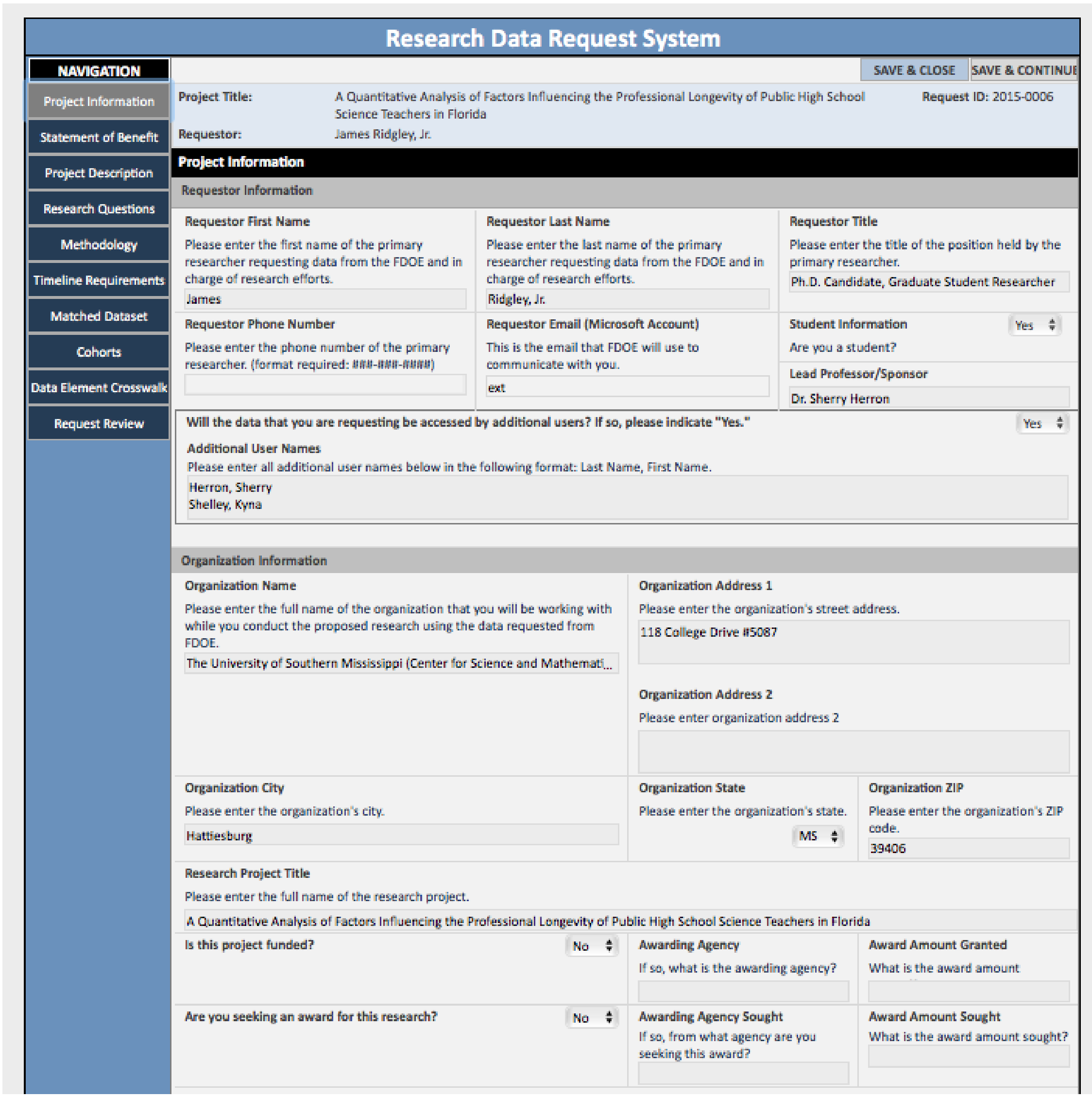
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: R15040201
PROJECT TITLE: A Quantitative Analysis of Factors Affecting the Professional Longevity of Public High School Science Teachers in Florida
PROJECT TYPE: Renewal of a Previously Approved Project
RESEARCHER(S): James A. Ridgley, Jr
COLLEGE/DIVISION: College of Science and Technology
DEPARTMENT: Center for Science and Math Education
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 05/04/2016 to 05/03/2017
**Lawrence A. Hosman, Ph.D.**
**Institutional Review Board**

# APPENDIX B – FLDOE Research Application

## Project Information



**Research Data Request System**

NAVIGATION

- Project Information
- Statement of Benefit
- Project Description
- Research Questions
- Methodology
- Timeline Requirements
- Matched Dataset
- Cohorts
- Data Element Crosswalk
- Request Review

SAVE & CLOSE | SAVE & CONTINUE

**Project Title:** A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

**Request ID:** 2015-0006

**Requestor:** James Ridgley, Jr.

**Project Information**

Requestor Information

**Requestor First Name**
Please enter the first name of the primary researcher requesting data from the FDOE and in charge of research efforts.
James

**Requestor Last Name**
Please enter the last name of the primary researcher requesting data from the FDOE and in charge of research efforts.
Ridgley, Jr.

**Requestor Title**
Please enter the title of the position held by the primary researcher.
Ph.D. Candidate, Graduate Student Researcher

**Requestor Phone Number**
Please enter the phone number of the primary researcher. (format required: ###-###-####)

**Requestor Email (Microsoft Account)**
This is the email that FDOE will use to communicate with you.
ext

**Student Information** Yes
Are you a student?

**Lead Professor/Sponsor**
Dr. Sherry Herron

**Will the data that you are requesting be accessed by additional users? If so, please indicate "Yes."** Yes

**Additional User Names**
Please enter all additional user names below in the following format: Last Name, First Name.
Herron, Sherry
Shelley, Kyna

Organization Information

**Organization Name**
Please enter the full name of the organization that you will be working with while you conduct the proposed research using the data requested from FDOE.
The University of Southern Mississippi (Center for Science and Mathemati...

**Organization Address 1**
Please enter the organization's street address.
118 College Drive #5087

**Organization Address 2**
Please enter organization address 2

**Organization City**
Please enter the organization's city.
Hattiesburg

**Organization State**
Please enter the organization's state.
MS

**Organization ZIP**
Please enter the organization's ZIP code.
39406

**Research Project Title**
Please enter the full name of the research project.
A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

**Is this project funded?** No

**Awarding Agency**
If so, what is the awarding agency?

**Award Amount Granted**
What is the award amount

**Are you seeking an award for this research?** No

**Awarding Agency Sought**
If so, from what agency are you seeking this award?

**Award Amount Sought**
What is the award amount sought?

Statement of Benefit

**Research Data Request System**

**NAVIGATION**

- Project Information
- Statement of Benefit
- Project Description
- Research Questions
- Methodology
- Timeline Requirements
- Matched Dataset
- Cohorts
- Data Element Crosswalk
- Request Review

PREVIOUS | SAVE & CLOSE | SAVE & CONTINUE

**Project Title:** A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida **Request ID:** 2015-0006

**Requestor:** James Ridgley, Jr.

**Statement of Benefit**

**Pursuant to 1008.385(1)(a), Florida Statutes, the Commissioner of Education has a responsibility to sponsor research that will provide information about educational needs or the effect of alternative educational practices. This section establishes how your research meets those requirements.**

Department Benefit Information

**Agenda Topics**

The Florida Department of Education (FDOE) takes pride in its commitment to making data from the statewide longitudinal data system available and accessible to researchers. The FDOE has a history of providing researchers access to its data (e.g., student assessment results, student course-taking patterns, a student-teacher link, and teacher certification results). Through Race to the Top (RTTT), a focused Research Agenda has been established. It is organized into broad topic areas consistent with the assurance areas of the grant and is intended to assist in the achievement of Florida's student achievement goals as well as to leverage the wealth of data available at the FDOE. Some research topics may require data that are not collected by the FDOE and/or may require combining FDOE data with data from other sources. Researchers are encouraged to incorporate qualitative components into the research proposal, if appropriate. Researchers wishing to access data from the FDOE's Education Data Warehouse (EDW) must clearly show how the request will support the needs outlined in the Research Agenda. Please select the specific FDOE Research Agenda topics(s) addressed by this study.

- [ ] 2013-14: (1) Standards and Assessments
- [x] 2013-14: (2) Great Teachers and Leaders
- [ ] 2013-14: (3) Turning Around Lowest-Achieving Schools
- [ ] 2013-14: (4) Charters/Choice
- [ ] 2013-14: (5) PK-20
- [ ] 2013-14: (6) Career and Adult Education
- [ ] 2013-14: (7) Florida Policy

**FDOE Offices**

Which specific FDOE offices will benefit from the proposed research? Select all that apply from the section below.

- [ ] K-12 Standards and Instructional Support
- [ ] School Improvement Services
- [ ] School Choice
- [ ] Exceptional Student Education
- [ ] Student Achievement Through Language Acquisition
- [x] Educator Quality
- [ ] Office of Articulation
- [ ] Office of Assessment
- [ ] Florida Colleges
- [ ] Career and Adult Education
- [ ] Student Financial Aid

**Department Knowledge**

Describe how your study will help extend the FDOE's knowledge and understanding of the topic(s) listed above.

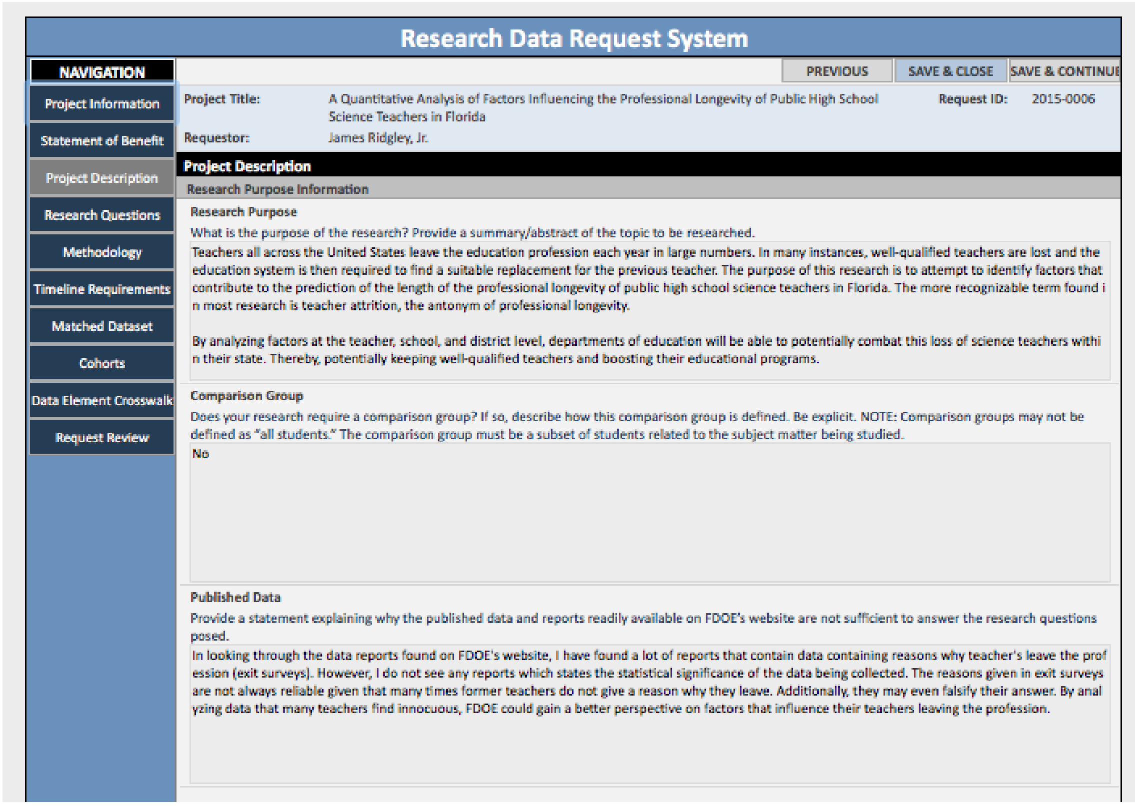
This study attempts to analyze various factors to determine if they are statistically significant in predicting the professional longevity (years of service) of pu blic high school science teachers in Florida. By conducting this study, FDOE will be able to see what factors may be influential in the departure of public high school science teachers.

**Department Usage**

How can the FDOE use the proposed publication/research in its final form?

The final form of the research will give FDOE the ability to see specifically what different factors influence the professional longevity of public high school sci ence teachers. With this information, FDOE could then develop strategies to help combat science teacher attrition. If a science teacher's professional longev ity can be increased then Florida will be able to retain quality science educators for longer periods of service.

Project Description



Research Data Request System

NAVIGATION
- Project Information
- Statement of Benefit
- Project Description
- Research Questions
- Methodology
- Timeline Requirements
- Matched Dataset
- Cohorts
- Data Element Crosswalk
- Request Review

PREVIOUS | SAVE & CLOSE | SAVE & CONTINUE

**Project Title:** A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

**Request ID:** 2015-0006

**Requestor:** James Ridgley, Jr.

**Project Description**

Research Purpose Information

**Research Purpose**

What is the purpose of the research? Provide a summary/abstract of the topic to be researched.

Teachers all across the United States leave the education profession each year in large numbers. In many instances, well-qualified teachers are lost and the education system is then required to find a suitable replacement for the previous teacher. The purpose of this research is to attempt to identify factors that contribute to the prediction of the length of the professional longevity of public high school science teachers in Florida. The more recognizable term found i n most research is teacher attrition, the antonym of professional longevity.

By analyzing factors at the teacher, school, and district level, departments of education will be able to potentially combat this loss of science teachers withi n their state. Thereby, potentially keeping well-qualified teachers and boosting their educational programs.

**Comparison Group**

Does your research require a comparison group? If so, describe how this comparison group is defined. Be explicit. NOTE: Comparison groups may not be defined as "all students." The comparison group must be a subset of students related to the subject matter being studied.

No

**Published Data**

Provide a statement explaining why the published data and reports readily available on FDOE's website are not sufficient to answer the research questions posed.

In looking through the data reports found on FDOE's website, I have found a lot of reports that contain data containing reasons why teacher's leave the prof ession (exit surveys). However, I do not see any reports which states the statistical significance of the data being collected. The reasons given in exit surveys are not always reliable given that many times former teachers do not give a reason why they leave. Additionally, they may even falsify their answer. By anal yzing data that many teachers find innocuous, FDOE could gain a better perspective on factors that influence their teachers leaving the profession.

Research Questions

**Research Data Request System**

NAVIGATION

- Project Information
- Statement of Benefit
- Project Description
- Research Questions
- Methodology
- Timeline Requirements
- Matched Dataset
- Cohorts
- Data Element Crosswalk
- Request Review

PREVIOUS | SAVE & CLOSE | SAVE & CONTINUE

**Project Title:** A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

**Request ID:** 2015-0006

**Requestor:** James Ridgley, Jr.

**Research Questions**

Research Questions Information

Research requests should be focused and demonstrate a direct relationship between the data elements requested, the research questions posed, and at least one of FDOE's Research Agenda topics. in order to be approved, a research request asking for anonymized student data must clearly demonstrate how the information gained from the research can be used to improve instruction. While the FDOE collects a vast array of information at all levels of education, data provided for a single research request are limited to the extent possible to maintain the confidentiality and integrity of the data. In order to provide the FDOE with a clear understanding of your data request, please provide the following detailed information. Some research topics may require data that are not collected by the FDOE and/or may require the combination of FDOE data with data from other sources. Researchers are encouraged to incorporate qualitative components into the research proposal, if appropriate. The FDOE's Data Request Review Committee reviews each proposal using the above criteria.

State and Federal Regulations

The Florida Department of Education requires all requests to comply with the Family Educational Rights and Privacy Act Regulation's (FERPA) research exception (34 CFR Part 99.31(6)(i)), which requires that the disclosure be to organizations conducting studies for, or on behalf of, educational agencies. In addition, the research must meet one of the following three allowable purposes. 1) to improve instruction; 2) to develop, validate, or administer predictive tests; or 3) to administer student aid programs. Requests must meet one of these criteria to be approved.

This study falls under the allowable purpose of improving instruction. By permitting this study, FDOE could potentially gain data that will assist them in the r etention of quality high school science educators.

Research Question Instructions

List the research question(s) to be answered by the proposed project and how they relate to the topics on the FDOE Research Agenda.

**The questions should be specific and numbered. DO NOT embed the questions in a descriptive paragraph. Each research question should be listed as a separate line item.**

3

**1. Research Question**

Is there a statistical relationship among selected independent variables (teacher's gender, age, ethnicity, college training, entrance training, and average sal ary; the teacher's school, school's socioeconomic status, and average class size; and the teacher's district, district's average spending per student, and aver

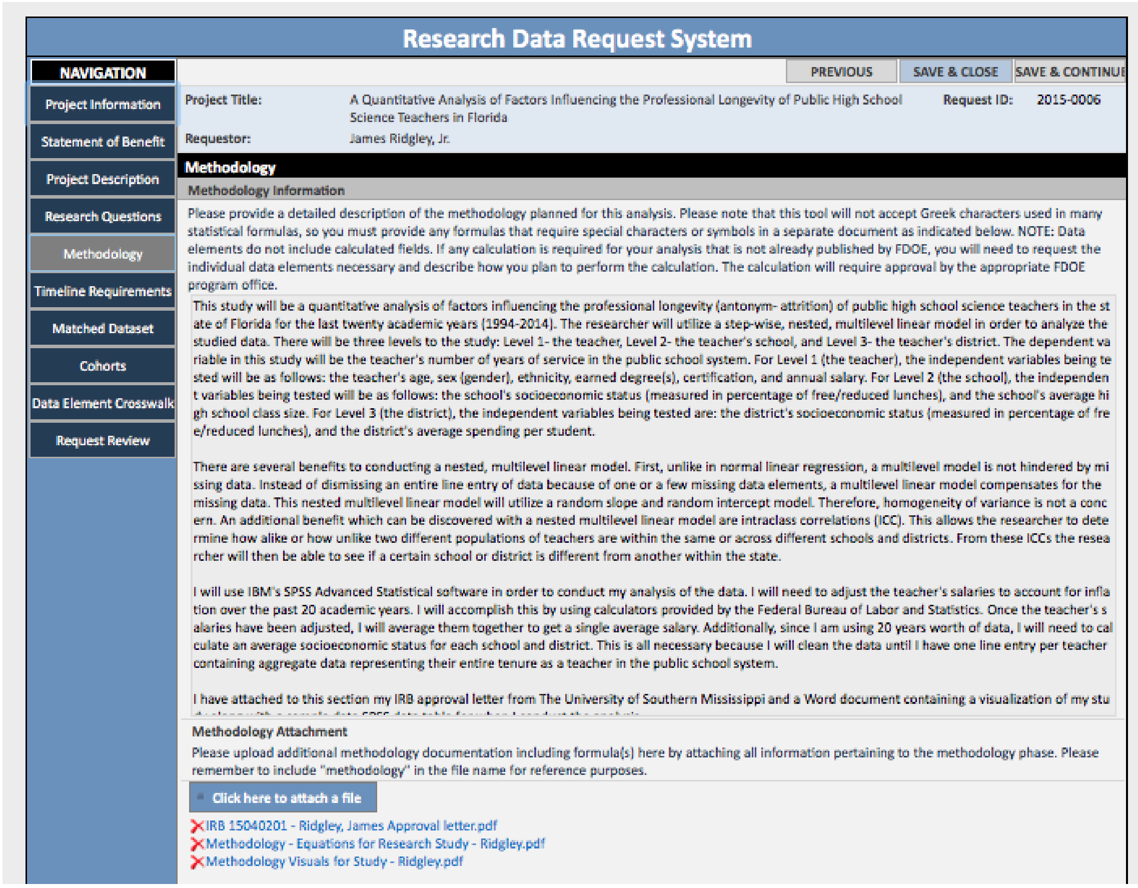
**2. Research Question**

Is there a statistical significant difference among the professional longevity of public high school science teachers at different high schools in the state of Flo rida?

**3. Research Question**

Is there a statistical significant difference among the professional longevity of public high school science teachers in different school districts in the state of Florida?

Methodology



Research Data Request System

NAVIGATION | PREVIOUS | SAVE & CLOSE | SAVE & CONTINUE

Project Information
Statement of Benefit
Project Description
Research Questions
Methodology
Timeline Requirements
Matched Dataset
Cohorts
Data Element Crosswalk
Request Review

Project Title: A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

Request ID: 2015-0006

Requestor: James Ridgley, Jr.

**Methodology**

Methodology Information

Please provide a detailed description of the methodology planned for this analysis. Please note that this tool will not accept Greek characters used in many statistical formulas, so you must provide any formulas that require special characters or symbols in a separate document as indicated below. NOTE: Data elements do not include calculated fields. If any calculation is required for your analysis that is not already published by FDOE, you will need to request the individual data elements necessary and describe how you plan to perform the calculation. The calculation will require approval by the appropriate FDOE program office.

This study will be a quantitative analysis of factors influencing the professional longevity (antonym- attrition) of public high school science teachers in the st ate of Florida for the last twenty academic years (1994-2014). The researcher will utilize a step-wise, nested, multilevel linear model in order to analyze the studied data. There will be three levels to the study: Level 1- the teacher, Level 2- the teacher's school, and Level 3- the teacher's district. The dependent va riable in this study will be the teacher's number of years of service in the public school system. For Level 1 (the teacher), the independent variables being te sted will be as follows: the teacher's age, sex (gender), ethnicity, earned degree(s), certification, and annual salary. For Level 2 (the school), the independen t variables being tested will be as follows: the school's socioeconomic status (measured in percentage of free/reduced lunches), and the school's average hi gh school class size. For Level 3 (the district), the independent variables being tested are: the district's socioeconomic status (measured in percentage of fre e/reduced lunches), and the district's average spending per student.

There are several benefits to conducting a nested, multilevel linear model. First, unlike in normal linear regression, a multilevel model is not hindered by mi ssing data. Instead of dismissing an entire line entry of data because of one or a few missing data elements, a multilevel linear model compensates for the missing data. This nested multilevel linear model will utilize a random slope and random intercept model. Therefore, homogeneity of variance is not a conc ern. An additional benefit which can be discovered with a nested multilevel linear model are intraclass correlations (ICC). This allows the researcher to dete rmine how alike or how unlike two different populations of teachers are within the same or across different schools and districts. From these ICCs the resea rcher will then be able to see if a certain school or district is different from another within the state.

I will use IBM's SPSS Advanced Statistical software in order to conduct my analysis of the data. I will need to adjust the teacher's salaries to account for infla tion over the past 20 academic years. I will accomplish this by using calculators provided by the Federal Bureau of Labor and Statistics. Once the teacher's s alaries have been adjusted, I will average them together to get a single average salary. Additionally, since I am using 20 years worth of data, I will need to cal culate an average socioeconomic status for each school and district. This is all necessary because I will clean the data until I have one line entry per teacher containing aggregate data representing their entire tenure as a teacher in the public school system.

I have attached to this section my IRB approval letter from The University of Southern Mississippi and a Word document containing a visualization of my stu

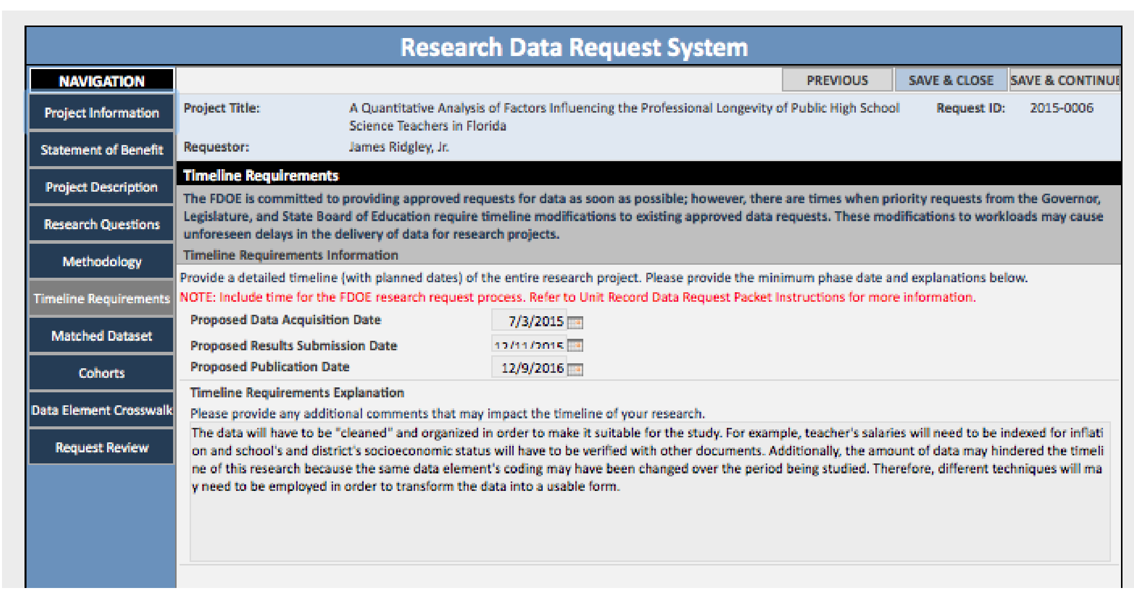
Methodology Attachment

Please upload additional methodology documentation including formula(s) here by attaching all information pertaining to the methodology phase. Please remember to include "methodology" in the file name for reference purposes.

Click here to attach a file

IRB 15040201 - Ridgley, James Approval letter.pdf
Methodology - Equations for Research Study - Ridgley.pdf
Methodology Visuals for Study - Ridgley.pdf

Timeline Requirements



Research Data Request System

NAVIGATION | PREVIOUS | SAVE & CLOSE | SAVE & CONTINUE

Project Information
Statement of Benefit
Project Description
Research Questions
Methodology
Timeline Requirements
Matched Dataset
Cohorts
Data Element Crosswalk
Request Review

Project Title: A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

Request ID: 2015-0006

Requestor: James Ridgley, Jr.

**Timeline Requirements**

**The FDOE is committed to providing approved requests for data as soon as possible; however, there are times when priority requests from the Governor, Legislature, and State Board of Education require timeline modifications to existing approved data requests. These modifications to workloads may cause unforeseen delays in the delivery of data for research projects.**

Timeline Requirements Information

Provide a detailed timeline (with planned dates) of the entire research project. Please provide the minimum phase date and explanations below.

NOTE: Include time for the FDOE research request process. Refer to Unit Record Data Request Packet Instructions for more information.

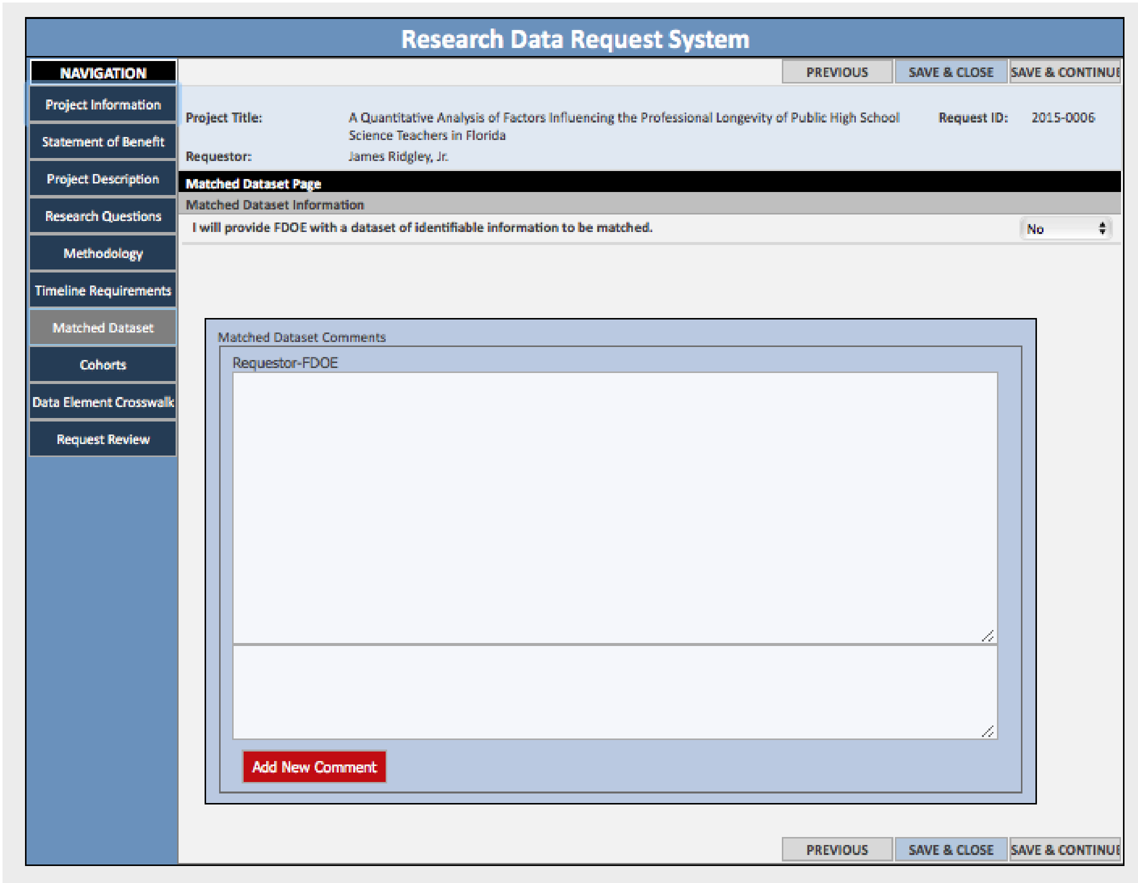
| | |
|---|---|
| Proposed Data Acquisition Date | 7/3/2015 |
| Proposed Results Submission Date | 12/11/2015 |
| Proposed Publication Date | 12/9/2016 |

Timeline Requirements Explanation

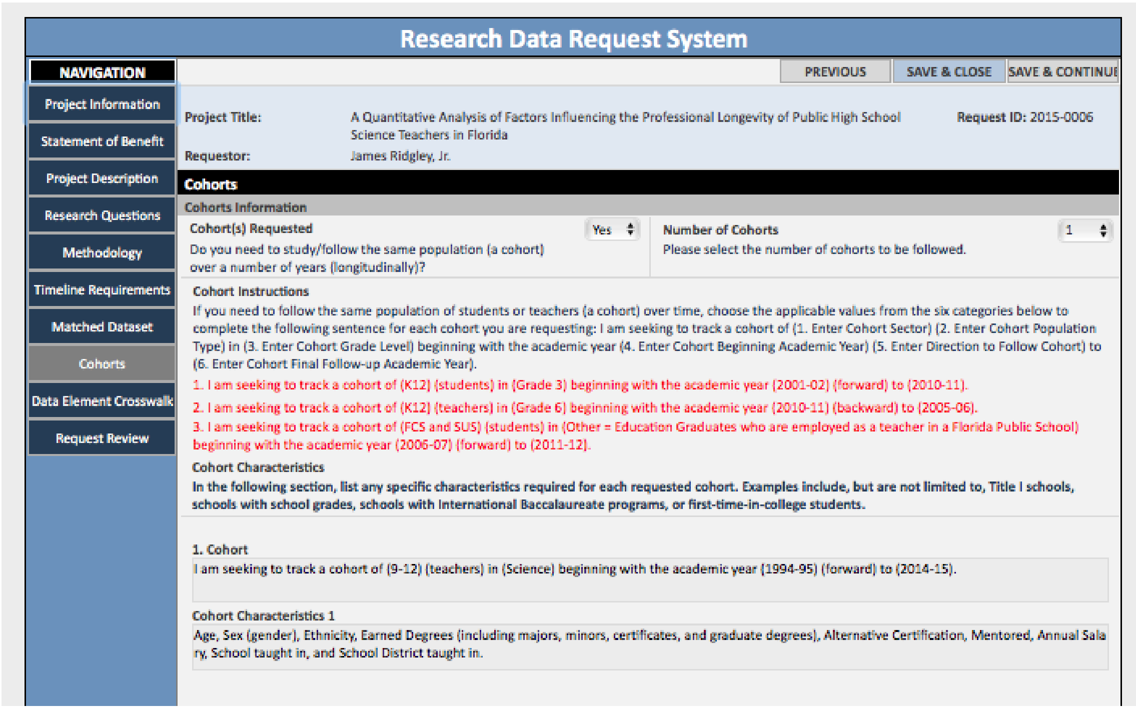
Please provide any additional comments that may impact the timeline of your research.

The data will have to be "cleaned" and organized in order to make it suitable for the study. For example, teacher's salaries will need to be indexed for inflati on and school's and district's socioeconomic status will have to be verified with other documents. Additionally, the amount of data may hindered the timeli ne of this research because the same data element's coding may have been changed over the period being studied. Therefore, different techniques will ma y need to be employed in order to transform the data into a usable form.

Matched Data Set



## Cohorts



Research Data Request System

NAVIGATION

Project Information
Statement of Benefit
Project Description
Research Questions
Methodology
Timeline Requirements
Matched Dataset
Cohorts
Data Element Crosswalk
Request Review

PREVIOUS | SAVE & CLOSE | SAVE & CONTINUE

**Project Title:** A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

**Request ID:** 2015-0006

**Requestor:** James Ridgley, Jr.

**Cohorts**

Cohorts Information

Cohort(s) Requested — Yes
Do you need to study/follow the same population (a cohort) over a number of years (longitudinally)?

Number of Cohorts — 1
Please select the number of cohorts to be followed.

Cohort Instructions

If you need to follow the same population of students or teachers (a cohort) over time, choose the applicable values from the six categories below to complete the following sentence for each cohort you are requesting: I am seeking to track a cohort of (1. Enter Cohort Sector) (2. Enter Cohort Population Type) in (3. Enter Cohort Grade Level) beginning with the academic year (4. Enter Cohort Beginning Academic Year) (5. Enter Direction to Follow Cohort) to (6. Enter Cohort Final Follow-up Academic Year).

1. I am seeking to track a cohort of (K12) (students) in (Grade 3) beginning with the academic year (2001-02) (forward) to (2010-11).
2. I am seeking to track a cohort of (K12) (teachers) in (Grade 6) beginning with the academic year (2010-11) (backward) to (2005-06).
3. I am seeking to track a cohort of (FCS and SUS) (students) in (Other = Education Graduates who are employed as a teacher in a Florida Public School) beginning with the academic year (2006-07) (forward) to (2011-12).

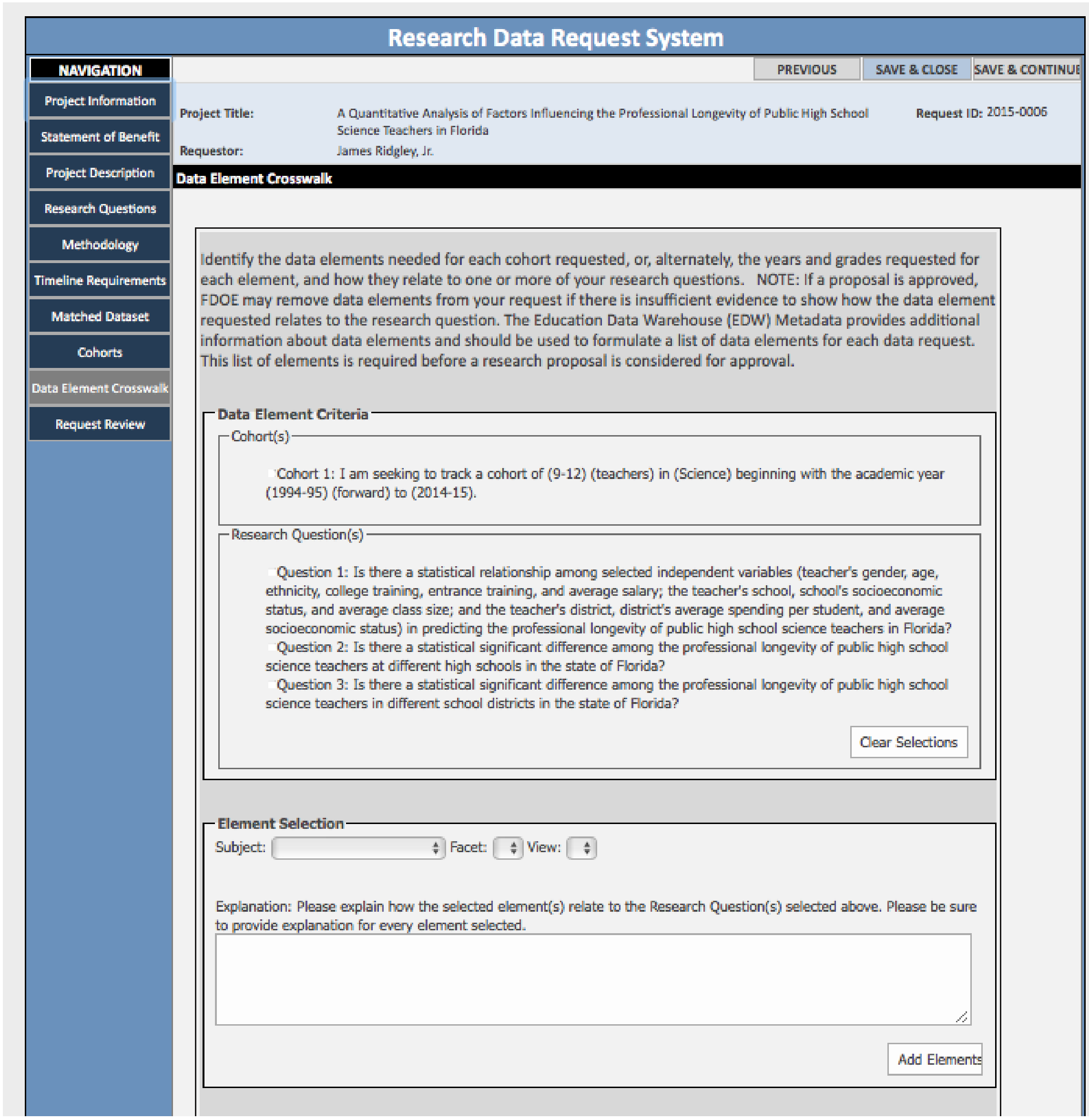
Cohort Characteristics

**In the following section, list any specific characteristics required for each requested cohort. Examples include, but are not limited to, Title I schools, schools with school grades, schools with International Baccalaureate programs, or first-time-in-college students.**

1. Cohort
I am seeking to track a cohort of (9-12) (teachers) in (Science) beginning with the academic year (1994-95) (forward) to (2014-15).

Cohort Characteristics 1
Age, Sex (gender), Ethnicity, Earned Degrees (including majors, minors, certificates, and graduate degrees), Alternative Certification, Mentored, Annual Salary, School taught in, and School District taught in.

Data Element Crosswalk



Research Data Request System

NAVIGATION

Project Information

Statement of Benefit

Project Description

Research Questions

Methodology

Timeline Requirements

Matched Dataset

Cohorts

Data Element Crosswalk

Request Review

PREVIOUS | SAVE & CLOSE | SAVE & CONTINUE

**Project Title:** A Quantitative Analysis of Factors Influencing the Professional Longevity of Public High School Science Teachers in Florida

**Request ID:** 2015-0006

**Requestor:** James Ridgley, Jr.

**Data Element Crosswalk**

Identify the data elements needed for each cohort requested, or, alternately, the years and grades requested for each element, and how they relate to one or more of your research questions. NOTE: If a proposal is approved, FDOE may remove data elements from your request if there is insufficient evidence to show how the data element requested relates to the research question. The Education Data Warehouse (EDW) Metadata provides additional information about data elements and should be used to formulate a list of data elements for each data request. This list of elements is required before a research proposal is considered for approval.

**Data Element Criteria**

Cohort(s)

Cohort 1: I am seeking to track a cohort of (9-12) (teachers) in (Science) beginning with the academic year (1994-95) (forward) to (2014-15).

Research Question(s)

Question 1: Is there a statistical relationship among selected independent variables (teacher's gender, age, ethnicity, college training, entrance training, and average salary; the teacher's school, school's socioeconomic status, and average class size; and the teacher's district, district's average spending per student, and average socioeconomic status) in predicting the professional longevity of public high school science teachers in Florida?

Question 2: Is there a statistical significant difference among the professional longevity of public high school science teachers at different high schools in the state of Florida?

Question 3: Is there a statistical significant difference among the professional longevity of public high school science teachers in different school districts in the state of Florida?

Clear Selections

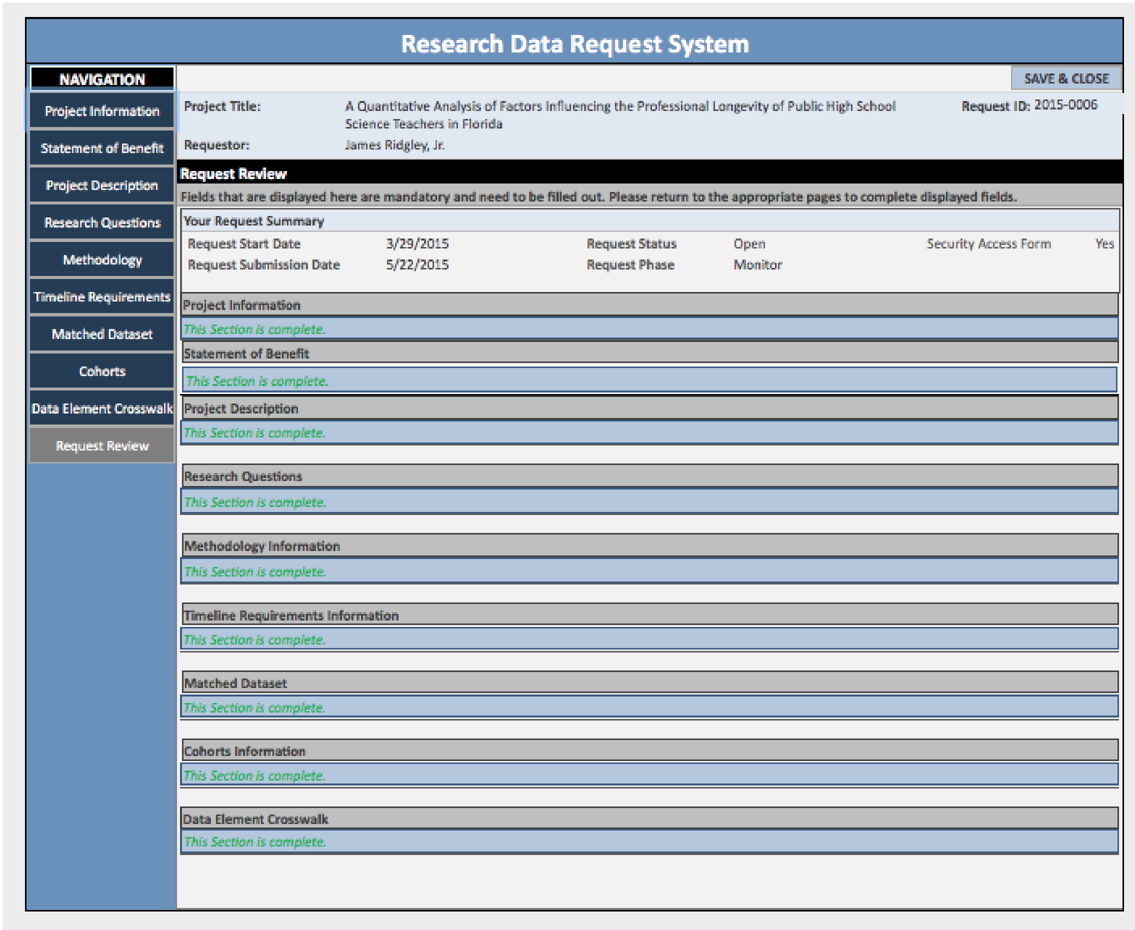
**Element Selection**

Subject: Facet: View:

Explanation: Please explain how the selected element(s) relate to the Research Question(s) selected above. Please be sure to provide explanation for every element selected.

Add Elements

Request Review



# APPENDIX C – Detailed Data Cleaning Techniques

## General Data Cleaning Technique

A variable included in each FLDOE text file is an EDW generated employee identifier, in order to link each piece of data back to a specific employee. First, each Excel file was separated into different tabs within the workbook by the studied year (i.e., 2011–2012, 2012–2013, 2013–2014, and 2014–2015) and sorted by EDW employee ID. This act made cleaning the data easier. Rows of data containing duplicated EDW employee IDs were removed from the data set. Once duplicated values were removed, the VLOOKUP function was utilized in order to merge the data from the various Excel files.

Once each data set was cleaned and assembled for each year of the study, all four tabs were merged into a single Excel file. This single Excel file was then sorted in descending order by year, and then ascending by EDW employee ID. By doing this, a teacher's final year of service was at the top of his or her grouping of employee data. Rows containing duplicated values of the EDW employee ID were then removed from the data set. This action left each teacher's final year of employment within the data set. The data from the 2014–2015 academic year were then removed from the data set because those teachers were outside the studied years and, therefore, for this study, were considered to be still teaching within the Florida school system. Once this act was completed, the final data set contained only those teachers who left the Florida school system during the studied period (2011–2012 to 2013–2014). This final data set was imported into SPSS.

## Specific Teacher-Level Data Cleaning

In order to acquire accurate data for several of the teacher level variables, further data cleaning steps were needed. The variables that required further cleaning were: number of places taught, migration count, Florida public years, Florida non-public years, out-of-state public years, out-of-state non-public years, military years, administration years, current district years, current assignment years, and total teaching years. As mentioned in the preceding paragraph, rows of data were deleted that contained duplicated values for the EDW employee ID. Those “extra” rows of data were deleted from the final data set because a unique EDW employee ID could appear only once. In the original files, duplicated EDW employee IDs existed because multiple rows contained data for the same employee. Therefore, a technique needed to be developed to transform these data from multiple rows into multiple columns.

First, the data were arranged by EDW employee ID to guarantee that all unique IDs were grouped together. In order to successfully separate the rows of data into columns matching the EDW employee ID, I created a formula using the IF function in Excel. This formula compared its row’s EDW employee ID with the EWD employee ID in the row above. If the EDW employee IDs were the same, the formula returned a value of “1” in the cell. If the EDW employee IDs were not the same, the formula returned a value of “0” in the cell. The formula was copied and pasted down a single column in the data file. In the next column of the data file, another IF function was used to compare its row’s EDW employee ID with EDW employee ID in the row below. Again, if the values were the same a value of “1” was returned. If the values were different a “0” was returned. This formula was copied and pasted in a single column in the data file.

Finally, a third column was created that compared the two previously created columns containing 0s and 1s. In this third column, I created a formula that used the IF and OR function in Excel. If adjacent cells in the two columns both contained a “1”, a value of “TRUE” was returned to the cell. If adjacent cells in the two columns were different a value of “FALSE” was returned. If a value of “TRUE” was returned, this meant that the EDW employee ID was duplicated. If a value of “FALSE” was returned, this represented the start of a new EDW employee ID and therefore a new “set” of data. Once these three columns were created, the values of these cells were copied and pasted so as not to lose the reference cell of the formula I created, and thereby change the results. From here it was simple work to use the VLOOKUP function in Excel to separate the rows of data into columns aligned by a teacher’s EDW employee ID.

*“Migration Count” Data Cleaning*

To successfully determine how many times a teacher moved among schools during the studied period, an additional technique had to be developed after the data were transformed from rows into columns. Since each row now represented a single EDW employee ID, I had the location where each teacher taught during each school year. I then created a formula using the IF function to compare a teacher’s schools throughout the study. Since three academic years were studied, I used two columns to compare the teacher’s schools. The first column compared the teacher’s second-year school to his or her first-year school, and the second column compared the third-year school to the second-year school. If the teacher stayed in the same school from year one to year two or from year two to year three, a value of “0” was returned. If the teacher changed schools, a value of “1” was returned. From these returned values, I was able to glean the migration count of an individual teacher.

### *“Number of Places Taught” Data Cleaning*

What also appeared in the data was the presence of teachers working at multiple schools during the same school year. Therefore, a COUNTIF function was used to create a formula to determine how many schools a teacher taught in during a single year of employment. These values were then used in the final data set. To return to the discussion in the previous paragraph, the presence of teachers who taught in multiple locations made it difficult to determine a teacher’s migration count. Therefore, I determined that a teacher’s migration count did not increase if his or her location load increased or decreased from one year to the next, as long as he or she was teaching in at least one of the same schools. For example, if a teacher taught at schools X and Y the first year and only at school X during the second year of teaching, this did not count toward the teacher’s migration count. However, if a teacher taught at schools X and Y the first year and at school Z the second year, this counted toward the teacher’s migration count.

## Specific School-Level Data Cleaning

The data cleaning of the school level variables included only one variable that needed cleaning, a school’s geographic location variable. This variable was collected from the NCES and was named “ULOCAL” within its data files. The original data consisted of a two-digit number for each high school. However, each digit represented a different aspect of the school. The format was very much like office rooms in a multistory building; the first digit represents the floor number and the second digit, the room number. Therefore, with the ULOCAL variable, the first digit represented the geographic location of the school, and the second digit represented the residential population density of the area where the school is located. These two digits were separated into separate columns by using the “Fixed Width” setting under the “Text to Column” function in Excel. Upon successfully separating the two digits, the first digit could represent one of four geographic locations for a school (city, suburb, town or rural). The second digit describes the relative residential population density of where a school is located (large/fringe, mid-size/distant, or small/remote). A summary of the coding, showing what each digit represents, (i.e., how NCES defines each of these variables) is found in Table A1.

Table A1.

*Coding Representation for ULOCAL Variable*

| Data Set Code | Description | Definition |
|---|---|---|
| Geographic Location | | |
| 1 | City | Territory inside an urbanized area |
| 2 | Suburb | Territory outside a principal city |
| 3 | Town | Territory inside an urban cluster |
| 4 | Rural | Census-defined rural territory |
| Population Density | | |
| 1 | Large / Fringe | Population of 250,000 or more / Less than 10 miles from an urbanized area |
| 2 | Mid-Size / Distant | Population of greater than 100,000 but less than 250,000 / Less than 35 miles but greater than 10 miles from an urbanized area |
| 3 | Small / Remote | Population less than 100,000 / Greater than 35 miles from an urbanized area |

Note. Definitions retrieved from www.nces.ed.gov. Accessed: 6/20/2016.

## Data Coding

In order to successfully conduct MLR and HMR statistical testing, all dependent and independent variables must either be continuous or categorical (Field, 2009). Before the coding scheme is discussed, I would like to mention what variables required the use of a “dummy” coding scheme to create categorical variables. The variables requiring a “dummy” coding scheme were: ethnicity, earned degree, geographic location, and residential population density. The coding scheme for the independent variables used in this study is found in Table A2. The presence of these “dummy” coding variables is what made the number of independent variables so large (38 in total). The professional longevity of a teacher is a continuous variable measured in years.

Table A2.

*Coding Scheme of Data Set Independent Variables*

| Variable | Type | Coding / Unit |
|---|---|---|
| Independent Variables (Teacher Level) | | |
| Age | Continuous | Years |
| Sex (Female, Male) | Categorical | 0 or 1 |
| Salary | Continuous | U.S. Dollars |
| Baccalaureate vs. Unknown | Categorical | 0 or 1 |
| Baccalaureate vs. Secondary | Categorical | 0 or 1 |
| Baccalaureate vs. Vocational | Categorical | 0 or 1 |
| Baccalaureate vs. Associate | Categorical | 0 or 1 |
| Baccalaureate vs. Masters | Categorical | 0 or 1 |
| Baccalaureate vs. Specialist | Categorical | 0 or 1 |
| Baccalaureate vs. Doctorate | Categorical | 0 or 1 |
| White vs. Asian | Categorical | 0 or 1 |
| White vs. Black | Categorical | 0 or 1 |
| White vs. Hispanic | Categorical | 0 or 1 |
| White vs. American Indian/Alaska | Categorical | 0 or 1 |
| White vs. Multiracial | Categorical | 0 or 1 |
| White vs. Native Hawaiian/Pacific Is. | Categorical | 0 or 1 |
| No. Places Taught | Continuous | $x \geq 0$ |
| Migration Count | Continuous | $x \geq 0$ |
| Florida Public | Continuous | Years |

Table A2 (continued).

| | | |
|---|---|---|
| Florida Non-Public | Continuous | Years |
| Out-of-State Public | Continuous | Years |
| Out-of-State Non-Public | Continuous | Years |
| Military | Continuous | Years |
| Administration | Continuous | Years |
| Current District | Continuous | Years |
| Current Assignment | Continuous | Years |
| Total Teaching | Continuous | Years |
| Independent Variables (School Level) | | |
| Average Class Size | Continuous | Students |
| Charter Status | Categorical | 0 or 1 |
| SES | Continuous | %FRL |
| Suburb vs. City | Categorical | 0 or 1 |
| Suburb vs. Town | Categorical | 0 or 1 |
| Suburb vs. Rural | Categorical | 0 or 1 |
| Large/Fringe vs. Midsize/Distant | Categorical | 0 or 1 |
| Large/Fringe vs. Small/Remote | Categorical | 0 or 1 |
| Independent Variables (District Level) | | |
| Average SES | Continuous | %FRL |
| Average Spending | Continuous | U.S. Dollars |

## APPENDIX D – Level 1 Detailed Results and Tests of Assumptions

### Model 1.1: Level 1 MLR (All Variables)

To begin the analysis, it was necessary to conduct exploratory regression analyses on all of the Level 1 independent variables. The variables initially proposed in the study were a teacher's age, sex, ethnicity, earned degree, and salary. Additional variables, requested by the FLDOE, were added to the model. These variables include: migration, years in Florida non-public schools, years in current district, and years in current assignment. After cleaning the data received by FLDOE, I noticed that additional variables could be gleaned from the data. Therefore, I added additional variables to the Level 1 model. These added variables include: number of places taught in a school year, years teaching in out-of-state public schools, years teaching in out-of-state non-public schools, years of service in the military, years of service in school administration, years of service teaching in Florida public schools, total years of service teaching outside the Florida school system, and total years in the teaching profession. Not counting the categorical "dummy" variables that were formed to analyze the ethnicity and earned degree of a teacher, a total of 15 independent variables were tested. When the categorical "dummy" variables were included, the total independent variables included in Model 1.1 totaled 28.

*Model 1.1 Results*

Since these initial models are merely an exploratory measure, I will not formally report all the values generally reported with a multiple linear regression. For Model 1.1, a multiple linear regression was conducted to predict the professional longevity of a high school science teacher in Florida based upon 28 independent variables. A significant regression equation was computed (F(26, 1976) = error, $p < .001$), with an $R^2$ of 1.00. Obviously, from the preceding equation, Model 1.1 does not produce a reliable statistical model. This is due to the presence of multicollinearity existing between several independent variables and the dependent variable. Additionally, SPSS excluded the variables "Florida Public Years" and "Total Years Outside of Florida" because their tolerance values reached less than .001. The coefficients for Model 1.1 are summarized in Table A3. Since the independent variables "Out-of-State Public Years," "Out-of-State Non-Public Years," and "Total Years of Teaching" explain the most variance within the model and exhibited multicollinearity ($r > 0.80$), they were removed from the statistical testing of Model 1.2.

Table A3.

*Coefficients for Model 1.1*

| Independent Variable[a] | *B* | *SE B* | *β* |
|---|---|---|---|
| Constant | 4.46 E–15 | .00 | |
| Age | –2.93 E–16 | .00 | .00 |
| Sex | 2.45 E–15 | .00 | .00 |
| Salary | 8.21 E–20 | .00 | .00 |
| Earned Degree | | | |
| Baccalaureate vs. Unknown | 8.19 E–15 | .00 | .00 |
| Baccalaureate vs. Secondary | –2.15 E–14 | .00 | .00 |
| Baccalaureate vs. Vocational | 1.27 E–14 | .00 | .00 |
| Baccalaureate vs. Associate | 4.33 E–15 | .00 | .00 |
| Baccalaureate vs. Masters | 9.46 E–16 | .00 | .00 |
| Baccalaureate vs. Specialist | –1.36 E–14 | .00 | .00 |
| Baccalaureate vs. Doctorate | 1.80 E–15 | .00 | .00 |
| Ethnicity | | | |
| White vs. Asian | 4.40 E–15 | .00 | .00 |
| White vs. Black | –8.75 E–16 | .00 | .00 |
| White vs. Hispanic | –1.46 E–15 | .00 | .00 |
| White vs. American Indian/Alaska | –3.49 E–15 | .00 | .00 |
| White vs. Multiracial | 1.46 E–15 | .00 | .00 |

Table A3 (continued).

| | | | |
|---|---|---|---|
| White vs. Native Hawaiian/Pacific Islander | 2.07 E–15 | .00 | .00 |
| No. Places Taught | –3.69 E–15 | .00 | .00 |
| Migration Count | –5.85 E–15 | .00 | .00 |
| Florida Non-Public Years | –5.42 E–15 | .00 | .00 |
| Out-of-State Public Years | –1.00 | .00 | –.38 |
| Out-of-State Non-Public Years | –1.00 | .00 | –.13 |
| Military Years | 8.64 E–16 | .00 | .00 |
| Administration Years | 6.76 E–16 | .00 | .00 |
| Current District Years | –4.76 E–15 | .00 | .00 |
| Current Assignment Years | –3.81 E–16 | .00 | .00 |
| Total Years of Teaching | 1.00 | .00 | 1.10 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

Model 1.2: Level 1 Regression (Three Variables Removed)

As determined by Model 1.1, the following variables were removed from the statistical analysis of Model 1.2: “Out-of-State Public Years,” “Out-of-State Non-Public Years,” and “Total Years of Teaching.” Once these variables were removed, another multiple linear regression was conducted. With the removal of the aforementioned three variables, this left 25 independent variables to be tested with the dependent variable.

*Model 1.2 Results*

Again I will not formally report all the values calculated by Model 1.2 since multicollinearity occurs between multiple independent variables, which required their removal from the final analysis. For Model 1.2, a multiple linear regression was conducted to predict the years of service a high school science teacher will serve in Florida based upon 25 independent variables. A significant regression equation was computed (F(25, 1977) = error, $p < .001$), with an $R^2$ of 1.00. As seen again from the preceding equation, Model 1.2 did not produce a reliable statistical model. Again, this was due to the presence multicollinearity ($r > 0.80$) existing between several independent variables and the dependent variable. The coefficients for Model 1.2 are summarized in Table A4. Since the independent variables “Florida Non-Public Years of Service” and “Florida Public School Years of Service” explain the most variance within the model, they were removed from the statistical testing of Model 1.3.

Table A4.

*Coefficients for Model 1.2*

| Independent Variable[a] | *B* | *SE B* | *β* |
|---|---|---|---|
| Constant | 1.21 E–14 | 0.00 | |
| Age | –3.54 E–16 | 0.00 | .00 |
| Sex | 1.08 E–15 | 0.00 | .00 |
| Salary | 5.29 E–20 | 0.00 | .00 |
| Earned Degree | | | |
| Baccalaureate vs. Unknown | –1.53 E–15 | 0.00 | .00 |
| Baccalaureate vs. Secondary | –5.84 E–15 | 0.00 | .00 |
| Baccalaureate vs. Vocational | 4.27 E–15 | 0.00 | .00 |
| Baccalaureate vs. Associate | 4.32 E–16 | 0.00 | .00 |
| Baccalaureate vs. Masters | 1.18 E–16 | 0.00 | .00 |
| Baccalaureate vs. Specialist | –2.04 E–15 | 0.00 | .00 |
| Baccalaureate vs. Doctorate | 2.28 E–15 | 0.00 | .00 |
| Ethnicity | | | |
| White vs. Asian | 1.39 E–15 | 0.00 | .00 |
| White vs. Black | 8.00 E–16 | 0.00 | .00 |
| White vs. Hispanic | –2.92 E–16 | 0.00 | .00 |
| White vs. American Indian/Alaska | –1.97 E–15 | 0.00 | .00 |
| White vs. Multiracial | –2.14 E–15 | 0.00 | .00 |
| White vs. Native Hawaiian/Pacific Islander | 4.96 E–15 | 0.00 | .00 |
| No. Places Taught | –1.62 E–15 | 0.00 | .00 |
| Migration Count | –1.18 E–15 | 0.00 | .00 |
| Florida Non-Public Years | 1.00 | 0.00 | .17 |
| Florida Public School Years | 1.00 | 0.00 | .99 |
| Military Years | 3.32 E–16 | 0.00 | .00 |
| Administration Years | 7.14 E–16 | 0.00 | .00 |
| Current District Years | –1.01 E–15 | 0.00 | .00 |
| Current Assignment Years | 1.14 E–15 | 0.00 | .00 |
| Total Years of Service Outside of Florida | 3.18 E–16 | 0.00 | .00 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

Model 1.3: Level 1 Regression (Two Variables Removed)

To continue this exploratory analysis, it is necessary to continue in this fashion in order to determine what variables accurately predict the model. As determined by Model 1.2, the following variables were removed from the statistical analysis of Model 1.3: "Florida Non-Public Years of Service" and "Florida Public Years of Service." Once these variables were removed, a multiple linear regression was conducted. With the removal of these two variables, this left 23 independent variables to test.

*Model 1.3 Results*

Again, I will not formally report all the values calculated by Model 1.3 since multicollinearity occurred between multiple independent variables. For Model 1.3, a multiple linear regression was conducted to predict the professional longevity of a high school science teacher in Florida based upon the remaining 23 independent variables. A significant regression equation was computed ($F(23, 1979) = 471.887$, $p < .001$), with an $R^2$ of .846. Although the amount of explained variance is now below 1.00, there still exists a high measure of multicollinearity ($r > 0.80$), between several independent variables and the dependent variable. The coefficients for Model 1.3 are summarized in Table A5.

In looking at Table A5, it is clear the unstandardized *B* values are approaching more "expected" values. Therefore, it now becomes important to consider a variable's VIF value, tolerance statistic, and whether an independent variable tests as being statistically significant. Since the VIF statistic of the independent variables "Current District Years of Service" (3.11) and "Current Assignment Years of Service" (2.47) tested above 1.00 respectively (signifying the presence of multicollinearity), and since these variables explain the most variance of the remaining length of service independent variables, they were removed from the statistical testing of Model 1.4. Importantly, if other independent variables (such as those comparing ethnicity and degree) did not test as being statistically significant, they were not removed from Model 1.4 because they are sub-variables of the larger independent variables of ethnicity and earned degree.

Table A5.

*Coefficients for Model 1.3*

| Independent Variable[a] | *B* | *SE B* | *β* | *t* | *Sig.* |
|---|---|---|---|---|---|
| Constant | –2.87 | .71 | | –4.04 | <.001 |
| Age | 0.12 | .01 | .17 | 14.45 | <.001 |
| Sex | –0.28 | .18 | –.01 | –1.53 | .126 |
| Salary | –7.74 E–6 | .00 | –.02 | –1.56 | .118 |
| Earned Degree | | | | | |
| Baccalaureate vs. Unknown | –1.92 | .52 | –.03 | –3.68 | <.001 |
| Baccalaureate vs. Secondary | 5.29 | 4.78 | .01 | 1.11 | .268 |
| Baccalaureate vs. Vocational | –1.95 | 3.91 | .00 | –0.50 | .618 |
| Baccalaureate vs. Associate | –1.22 | .74 | –.02 | –1.65 | .099 |
| Baccalaureate vs. Masters | 0.34 | .21 | .02 | 1.65 | .099 |
| Baccalaureate vs. Specialist | 2.46 | .94 | .02 | 2.63 | .009 |
| Baccalaureate vs. Doctorate | –0.81 | .48 | –.02 | –1.68 | .092 |
| Ethnicity | | | | | |
| White vs. Asian | –0.58 | .50 | –.01 | –1.16 | .248 |
| White vs. Black | –0.20 | .27 | –.01 | –0.74 | .461 |
| White vs. Hispanic | –0.38 | .31 | –.01 | –1.22 | .221 |
| White vs. American Indian/Alaska | 0.70 | 1.13 | .01 | 0.62 | .535 |
| White vs. Multiracial | –0.31 | .71 | .00 | –0.44 | .659 |
| White vs. Native Hawaiian/Pacific Is. | –5.99 | 2.77 | –.02 | –2.16 | .031 |
| No. Places Taught | 0.51 | .63 | .01 | 0.81 | .420 |
| Migration Count | 0.70 | .37 | .02 | 1.88 | .061 |
| Military Years | –0.29 | .11 | –.02 | –2.59 | .010 |
| Administration Years | –0.05 | .09 | –.01 | –0.57 | .572 |
| Current District Years | 0.88 | .02 | .80 | 51.60 | <.001 |
| Current Assignment Years | 0.02 | .09 | .01 | 1.03 | .302 |
| Total Years of Service Outside of Florida | 0.13 | .02 | .02 | –4.72 | <.001 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

Model 1.4: Level 1 Regression (Two Variables Removed)

As determined by Model 1.3, the following independent variables were removed from the statistical analysis of Model 1.4: "Current District Years of Service" and "Current Assignment Years of Service." Once these variables were removed, a multiple linear regression was conducted. With the removal of the two aforementioned variables, this left 21 independent variables to be tested with the dependent variable, the professional longevity of a high school science teacher. The following paragraphs discuss the results of Model 1.4.

*Model 1.4 Results*

For Model 1.4, a multiple linear regression was conducted to predict the years of service of a high school science teacher based upon the remaining 21 independent variables. A significant regression equation was computed (F(21, 1981) = 78.084, $p < .001$), with an $R^2$ of .447. The coefficients for Model 1.4 are summarized in Table A6. In looking at Table A6, it is clear that the unstandardized *B* values are continuing to approach more "expected" values. Therefore, it continues to be important to consider whether an independent variable tests as statistically significant. Since the VIF statistic of the independent variable's "Total Years of Service Outside Florida" (1.145) tested above 1.00 (signifying the presence of potential multicollinearity), and since the independent variables "Military Years of Service" and "Administration Years of Service" tested as non-significant, they were removed from the statistical testing for Model 1.5. Importantly, if other independent variables (such as those comparing ethnicity and degree) did not test as being statistically significant, they were not removed from the statistical analysis for Model 1.5 because they are sub-variables of the larger variables of ethnicity and earned degree.

Table A6.

*Coefficients for Model 1.4*

| Independent Variable[a] | *B* | *SE B* | *β* | *t* | *Sig.* |
|---|---|---|---|---|---|
| Constant | –11.73 | 1.32 | | –8.89 | <.001 |
| Age | 0.45 | 0.01 | .62 | 32.99 | <.001 |
| Sex | –0.24 | 0.35 | –.01 | –0.69 | .490 |
| Salary | –7.76 E–5 | 0.00 | .15 | 8.58 | <.001 |
| Earned Degree | | | | | |
| Baccalaureate vs. Unknown | –4.69 | 0.98 | –.08 | –4.78 | <.001 |
| Baccalaureate vs. Secondary | 14.39 | 8.99 | .03 | 1.60 | .110 |
| Baccalaureate vs. Vocational | 6.39 | 7.34 | .02 | 0.87 | .384 |
| Baccalaureate vs. Associate | –6.10 | 1.38 | –.07 | –4.42 | <.001 |
| Baccalaureate vs. Masters | 0.62 | 0.39 | .03 | 1.58 | .114 |
| Baccalaureate vs. Specialist | 2.92 | 1.76 | .03 | 1.66 | .097 |
| Baccalaureate vs. Doctorate | –3.88 | 0.90 | –.07 | –4.29 | <.001 |
| Ethnicity | | | | | |
| White vs. Asian | –2.03 | 0.95 | –.04 | –2.14 | .032 |
| White vs. Black | –1.15 | 0.50 | –.04 | –2.31 | .021 |
| White vs. Hispanic | –2.37 | 0.59 | –.07 | –4.06 | <.001 |
| White vs. American Indian/Alaska | –4.08 | 2.13 | –.03 | –1.92 | .055 |
| White vs. Multiracial | –0.22 | 1.33 | .00 | –0.16 | .871 |
| White vs. Native Hawaiian/Pacific Is. | –16.43 | 5.21 | –.07 | –3.15 | .002 |
| No. Places Taught | –0.53 | 1.18 | .00 | –0.45 | .651 |
| Migration Count | –1.017 | 0.70 | –.03 | –1.46 | .146 |
| Military Years | –0.261 | 0.21 | –.02 | –1.26 | .209 |
| Administration Years | –0.08 | 0.16 | .01 | 0.48 | .631 |
| Total Years of Service Outside of Florida | –0.32 | 0.05 | –.13 | –7.26 | <.001 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

## Model 1.5: Level 1 Regression (Three Variables Removed)

As determined by Model 1.4, the following independent variables were removed from the statistical analysis for Model 1.5: "Military Years of Service," "Administration Years of Service," and "Total Years of Service Outside of Florida." Once these variables were removed, a multiple linear regression was conducted. The remaining independent variables were statistically tested with the dependent variable, the professional longevity of a high school science teacher. The following paragraphs discuss the results of Model 1.5.

*Model 1.5 Results*

I will not formally report all the values calculated by Model 1.5 since again variables were removed from this model. For Model 1.5, a multiple linear regression was conducted to predict the professional longevity of a high school science teacher based upon the remaining 18 independent variables. A significant regression equation was computed ($F(18, 1984) = 85.923$, $p < .001$), with an $R^2$ of .433. The coefficients for Model 1.5 are summarized in Table A7. In looking at Table A7, it is clear that the unstandardized *B* values are continuing to approach more "expected" values. Therefore, it continues to be important to consider whether an independent variable tests as statistically significant. Since the independent variables "Number of Places Taught" and "Migration Count" test as statistically non-significant, they were removed from the statistical testing of Model 1.6.

The removal of these two variables results in all the Level 1 (teacher) variables that FLDOE suggested and the ones added by myself because of the available data, were removed from the Level 1 analysis. Therefore, the only variables remaining to test in Model 1.6 were the variables originally suggested. Importantly, if other independent variables (such as those comparing ethnicity and degree) did not test as statistically significant, they were not removed from Model 1.5 because they are sub-variables of the larger variables of ethnicity and earned degree in which some did test as being statistically significant. Additionally, the independent variable of a teacher's sex,

Table A7.

*Coefficients for Model 1.5*

| Independent Variable[a] | *B* | *SE B* | *β* | *t* | *Sig.* |
|---|---|---|---|---|---|
| Constant | –10.98 | 1.33 | | –8.25 | <.001 |
| Age | 0.42 | 0.01 | .58 | 31.98 | <.001 |
| Sex | –0.32 | 0.35 | –.02 | –0.91 | .362 |
| Salary | –7.83 E–5 | 0.00 | .15 | 8.55 | <.001 |
| Earned Degree | | | | | |
| Baccalaureate vs. Unknown | –4.48 | 0.99 | –.08 | –4.52 | <.001 |
| Baccalaureate vs. Secondary | 13.98 | 9.10 | .03 | 1.54 | .125 |
| Baccalaureate vs. Vocational | 7.40 | 7.43 | .02 | 1.00 | .320 |
| Baccalaureate vs. Associate | –5.76 | 1.40 | –.07 | –4.12 | <.001 |
| Baccalaureate vs. Masters | 0.19 | 0.39 | .01 | 0.48 | .635 |
| Baccalaureate vs. Specialist | 3.02 | 1.77 | .03 | 1.71 | .088 |
| Baccalaureate vs. Doctorate | –3.72 | 0.91 | –.07 | –4.08 | <.001 |
| Ethnicity | | | | | |
| White vs. Asian | –2.17 | 0.96 | –.04 | –2.27 | .023 |
| White vs. Black | –1.00 | 0.50 | –.03 | –1.98 | .048 |
| White vs. Hispanic | –2.18 | 0.59 | –.06 | –3.69 | <.001 |
| White vs. American Indian/Alaska | –3.84 | 2.15 | –.03 | –1.78 | .075 |
| White vs. Multiracial | –0.26 | 1.35 | .00 | –0.19 | .847 |
| White vs. Native Hawaiian/Pacific Is. | –16.09 | 5.26 | –.06 | –3.06 | .002 |
| No. Places Taught | –0.50 | 1.19 | –.01 | –0.42 | .675 |
| Migration Count | –1.01 | 0.71 | –.03 | –1.43 | .153 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

although it did not test as statistically significant, was not removed from Model 1.6 in an effort to see if a person's sex does influence the professional longevity of teachers, since there is research to suggest that it may.

## Model 1.6: Level 1 Regression (Two Variables Removed)

As determined by Model 1.5, the following independent variables were removed from the statistical analysis for Model 1.6: "Number of Places Taught" and "Migration Count." Once these variables were removed, a multiple linear regression was conducted.

With the removal of these two variables, 16 independent variables remained to be tested with the dependent variable.

*Model 1.6 Variable Coding*

When coding these variables, a teacher's age is measured in years; their sex is coded as 0 = Female, 1 = Male; and their salary is measured in U.S. dollars. A teacher's degree used the following "dummy" coding scheme: Baccalaureate vs. Unknown is coded as 0 = all other degrees, 1 = Unknown; Baccalaureate vs. Secondary is coded as 0 = all other degrees, 1 = Secondary; Baccalaureate vs. Vocational is coded as 0 = all other degrees, 1 = Vocational; Baccalaureate vs. Associate is coded as 0 = all other degrees, 1 = Associate; Baccalaureate vs. Masters is coded as 0 = all other degrees, 1 = Masters; Baccalaureate vs. Specialist is coded as 0 = all other degrees, 1 = Specialist; and Baccalaureate vs. Doctorate is coded as 0 = all other degrees, 1 = Doctorate. Earned degrees of teachers are all compared to a baccalaureate degree because this degree type represents the majority of the data set's population.

Regarding the ethnicity of a teacher, the following "dummy" coding scheme is employed: White vs. Asian is coded as 0 = all other ethnicities, 1 = Asian; White vs. Black is coded as 0 = all other ethnicities, 1 = Black; White vs. Hispanic is coded as 0 = all other ethnicities, 1 = Hispanic; White vs. American Indian/Alaska Native is coded as 0 = all other ethnicities, 1 = American Indian/Alaska Native; White vs. Multiracial is coded as 0 = all other ethnicities, 1 = Multiracial; and White vs. Native Hawaiian/Pacific Islander is coded as 0 = all other ethnicities, 1 = Native Hawaiian/Pacific Islander. A teacher's ethnicity is compared to the White ethnicity because this ethnicity represents the majority of the data set's population.

*Model 1.6 Detailed Results*

Model 1.6 is discussed further in Chapter IV. However, Table A8 displays a more detailed presentation of Model 1.6's coefficients, standardized beta values, *t*-scores, and each independent variable's significance. For more discussion concerning Model 1.6, refer to the appropriate sections in Chapters IV and V.

Table A8.

*Coefficients for Model 1.6*

| Independent Variable[a] | *B* | *SE B* | *β* | *t* | *Sig.* |
|---|---|---|---|---|---|
| Constant | –11.54 | 0.61 | | –18.97 | <.001 |
| Age | 0.42 | 0.01 | .59 | 32.06 | <.001 |
| Sex | –0.33 | 0.35 | –.02 | –0.95 | .342 |
| Salary | 7.80 E–5 | 0.00 | .15 | 8.53 | <.001 |
| Earned Degree | | | | | |
| Baccalaureate vs. Unknown | –4.41 | 0.99 | –.08 | –4.45 | <.001 |
| Baccalaureate vs. Secondary | 14.50 | 9.09 | .03 | 1.60 | .111 |
| Baccalaureate vs. Vocational | 7.43 | 7.43 | .02 | 1.00 | .318 |
| Baccalaureate vs. Associate | –5.70 | 1.40 | –.07 | –4.08 | <.001 |
| Baccalaureate vs. Masters | 0.18 | 0.39 | .01 | 0.46 | .646 |
| Baccalaureate vs. Specialist | 2.91 | 1.77 | .03 | 1.65 | .099 |
| Baccalaureate vs. Doctorate | –3.71 | 0.91 | –.07 | –4.07 | <.001 |
| Ethnicity | | | | | |
| White vs. Asian | –2.20 | 0.96 | –.04 | –2.30 | .022 |
| White vs. Black | –1.03 | 0.50 | –.04 | –2.05 | .041 |
| White vs. Hispanic | –2.22 | 0.59 | –.07 | –3.77 | <.001 |
| White vs. American Indian/Alaska | –3.99 | 2.15 | –.03 | –1.86 | .064 |
| White vs. Multiracial | –0.24 | 1.35 | .00 | –0.18 | .858 |
| White vs. Native Hawaiian | –16.55 | 5.25 | –.07 | –3.15 | .002 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools).

*Model 1.6 Tests of Assumptions*

Eight assumptions were checked in order to determine whether Model 1.6 produces biased results. First, all variables, both dependent and independent, are either continuous or categorical variables. Professional longevity, age, and salary are quantitative continuous variables; and sex, degree (all types), and ethnicity (all types) are categorical variables, as mentioned in the "dummy" coding scheme in the preceding paragraphs. Second, all predictors have variation (non-zero variance). This was exhibited by the fact that SPSS did not return any warnings in its output. Third, there is no multicollinearity ($r > 0.80$) between any independent variables. The highest correlation exhibited ($r = .577$) in Model 1.6 existed between the independent variables "Baccalaureate vs. Secondary" and "White vs. Native Hawaiian/Pacific Islander."

Next, the assumption of homoscedasticity was examined. Homoscedasticity was visually examined by plotting the regression's standardized residuals versus the standardized predicted values. The plot of these values is seen in Figure A1. In order to have homoscedasticity, the data values should be evenly spread around the zero-mark of both axes. However, Figure A1 is clearly shaped in a sideways "V." This means that the data displays heteroscedasticity or is not normally distributed. Further exploration of the data revealed that most of the independent variables were normally distributed. However, regarding the dependent variable, it was determined it is not normally distributed. In fact, the data were heavily skewed right. This is seen in Figure A2 and is further confirmed by Table 4 previously in Chapter IV.

The next assumption tested was the assumption of independent errors. In order to determine if the assumption of independent errors was met, it was necessary to perform a Durbin-Watson test, which examines correlations between residuals. The value returned from the Durbin-Watson test of the Model 1.6 multiple linear regression was 2.003. Since the Durbin-Watson value is close to 2.00, the assumption of independent errors was met. The model summary of the multiple regression is found in Table A9.

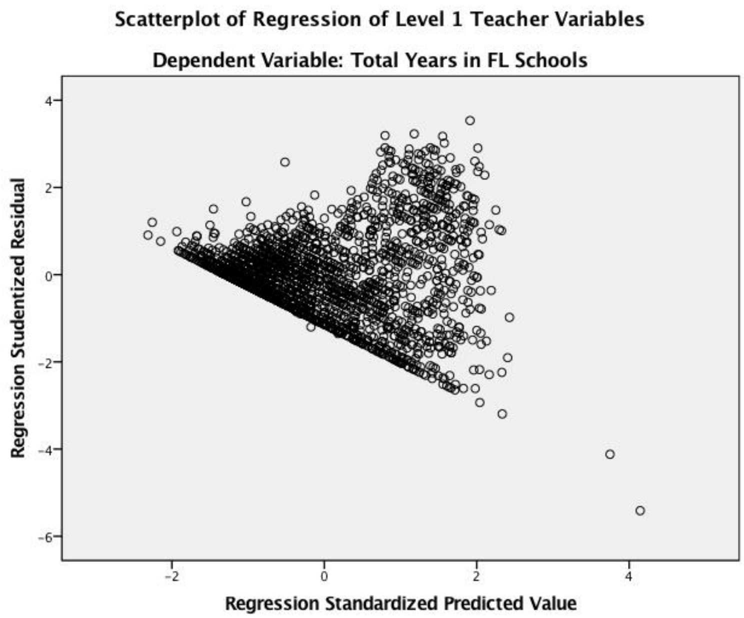



*Figure A1.* Scatterplot of Level 1 standardized residuals and predicted values.

Note. Data displays heteroscedasticity due to the presence of non-normally distributed dependent variable.

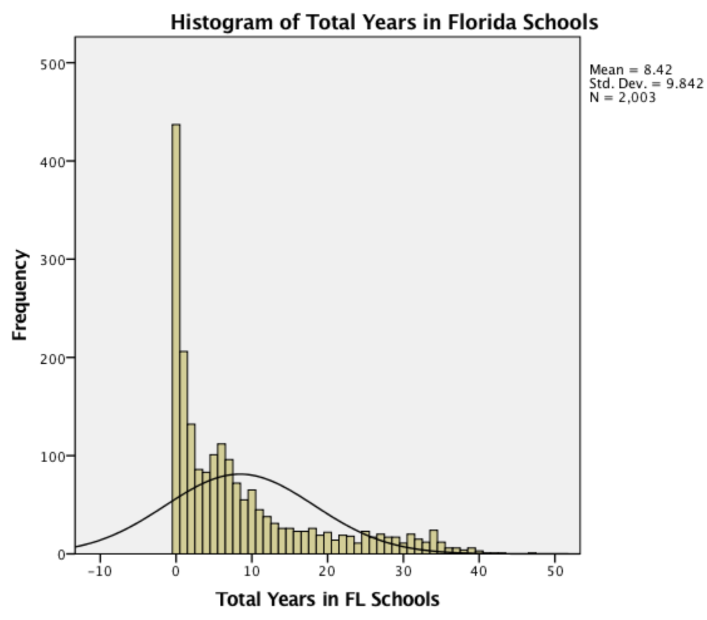



*Figure A2.* Histogram of the professional longevity dependent variable.

Note. Data is heavily skewed right due to the high frequency of low years of service in the Florida school system. Therefore, the dependent variable is not normally distributed. It is amazing to see how many teachers did not complete one year of teaching before leaving the Florida education system.

Table A9.

*Model Summary of Level 1 Teacher Independent Variables*

| Model[a] | *R* | $R^2$ | *SEE* | *F* | $df_1$ | $df_2$ | *Sig.* | *Durbin-Watson* |
|---|---|---|---|---|---|---|---|---|
| 1 | .661[b] | .437 | 7.412 | 96.487 | 16 | 1986 | .000 | 2.003 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools). [b]Predictors: Age, Sex, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Secondary, Baccalaureate vs. Vocational, Baccalaureate vs. Associate, Baccalaureate vs. Masters, Baccalaureate vs. Specialist, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. American Indian/Alaska Native, White vs. Multiracial, White vs. Native Hawaiian/Pacific Islander.

The next assumption needing testing was to see if the model had normally distributed errors. After saving the residuals from the Level 1 analysis, I ran a frequency distribution to determine if the errors were normally distributed. A histogram was plotted and it showed that the distribution of the data displayed a skewness of 0.229 and a kurtosis of 0.874. The histogram plot of the residuals is seen in Figure A3. From Figure A3 we can see that the distribution of the residuals is nearly normal, having a small skewness and kurtosis. Therefore, the assumption of normally distributed error is met.

The next assumption that was addressed was that each value of the dependent variable is independent and comes from a separate data entry. Within this data set, all individual values of the dependent variable were independent and belonged to a single data entry.

The last assumption examined was the assumption of linearity. This assumption examines whether the model being tested is linear or non-linear. When a model is linear it means that each predicted value for each independent variable must lie along a straight line. In order to see if Model 1.6 is linear, it becomes necessary to graph a P–P plot of the regression of the standardized residuals. This plot is seen in Figure A4. Although the line is not completely straight, it was determined that most of the variation in the line was due to the non-normality of the dependent variable. Since this was the cause of the variation in the line, the model is in essence linear.

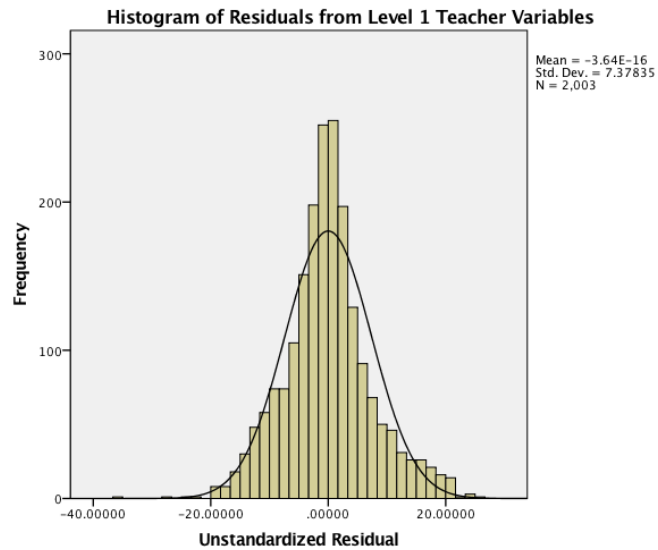



*Figure A3.* Histogram of unstandardized residuals from Level 1 analysis.

Note. Data displayed is nearly normal having a relatively small skewness and kurtosis.

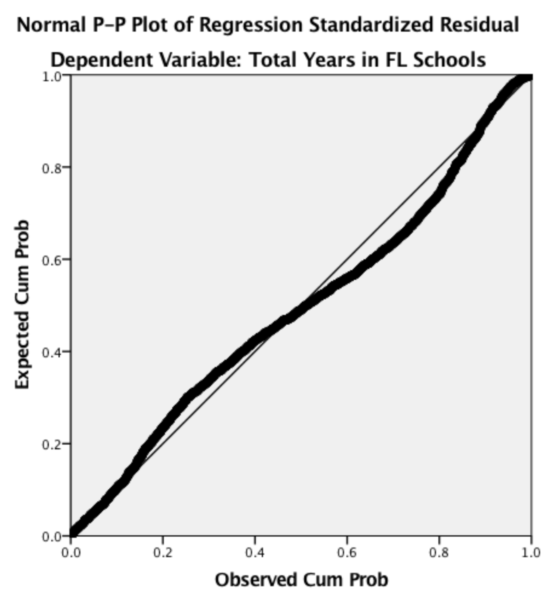



*Figure A4.* P–P plot of regression of Level 1 standardized residuals.

Note. Model 1.6 is nearly linear since the variation in the line is due to a non-normal distribution of the dependent variable.

## APPENDIX E – Level 2 Detailed Results and Tests of Assumptions

### Model 2.1: Level 2 MLR (All Variables)

*Model 2.1 Variable Coding*

When coding these variables, a school's average class size is continuous, measured in number of students; the school's charter status is coded as 0 = Public, 1 = Charter; and the school's SES is continuous, measured as a percentage of school's 9–12 grade student population that receives free/reduced lunch. A school's geographic location uses the following "dummy" coding scheme: Suburb vs. City is coded as 0 = all other locations, 1 = City; Suburb vs. Town is coded as 0 = all other locations, 1 = Town; and Suburb vs. Rural is coded as 0 = all other locations, 1 = Rural. Regarding the population density of a school, the following "dummy" coding scheme is employed: Large/Fringe vs. Midsize/Distant is coded as 0 = all other population densities, 1 = Midsize/Distant and Large/Fringe vs. Small/Remote is coded as 0 = all other population densities, 1 = Small/Remote. The geographic location and residential population densities were compared to Suburb and Large/Fringe, respectively, since both represent the majority geographic locations and population densities of the schools respectively.

*Model 2.1 Tests of Assumptions*

Eight assumptions were checked in order to determine whether Model 2.1 produces biased results. First, all variables, both dependent and independent, are either continuous or categorical variables. The professional longevity, average class size, and SES are quantitative continuous variables; and geographic location (all types), and population density (all types) are categorical variables as mentioned in the "dummy" coding scheme in the preceding paragraphs. Second, all predictors have variation (non-zero variance). This is exhibited by the fact that SPSS did not return any warnings in its output. Third, there was no multicollinearity ($r > 0.80$) between any independent variables. The highest correlation exhibited ($r = .339$) in Model 2.1 existed between the independent variables "Suburb vs. City" and "Large/Fringe vs. Small/Remote."

Next, the assumption of homoscedasticity was examined. Homoscedasticity was visually examined by plotting the regression's standardized residuals versus the standardized predicted values. The plot of these values is seen in Figure A5. In order to have homoscedasticity, the data values should be evenly spread around the zero-mark of both axes. However, Figure A5 clearly has most of the data lie along a downward sloping line. This means the data displays heteroscedasticity or is not normally distributed. Further exploration of the data revealed that most of the independent variables were normally distributed. However, regarding the dependent variable, it was found to not be normally distributed. In fact, the data were heavily skewed right. This can be seen previously in Appendix D, Figure A2.

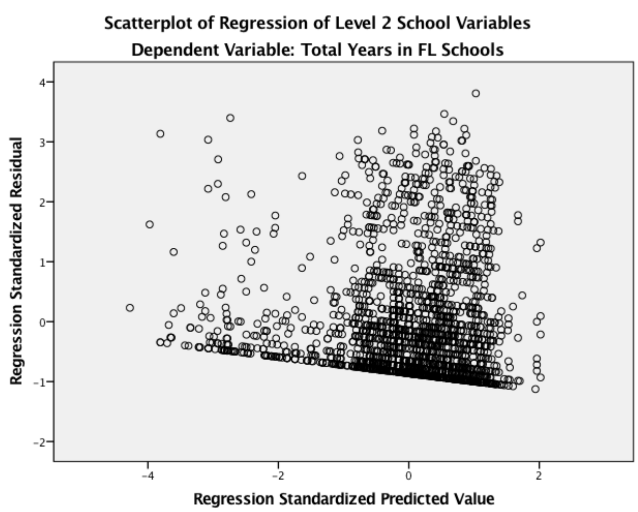



*Figure A5.* Scatterplot of regression of Level 2 school variables.

Note. Data displays heteroscedasticity due to the presence of a non-normal distribution of the dependent variable.

The next assumption tested was the assumption of independent errors. In order to determine if the assumption of independent errors was met, it was necessary to perform a Durbin-Watson test, which examines correlations between residuals. The value returned from the Durbin-Watson test of the Level 2 multiple linear regression was 1.931. Since the Durbin-Watson value is close to 2.00, the assumption of independent errors was met. The model summary of the multiple regression is found in Table A10.

Table A10.

*Model Summary of Level 2 School Independent Variables*

| Model[a] | *R* | $R^2$ | *SEE* | *F* | $df_1$ | $df_2$ | *Sig.* | *Durbin-Watson* |
|---|---|---|---|---|---|---|---|---|
| 1 | .135[b] | .018 | 9.772 | 4.607 | 8 | 1994 | .000 | 1.931 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools). [b]Predictors: Average Class Size, Charter Status, SES, Suburb vs. City, Suburb vs. Town, Suburb vs. Rural, Large/Fringe vs. Midsize/Distant, and Large/Fringe vs. Small/Remote.

The next assumption needing testing was that the model has normally distributed errors. After saving the residuals from the Level 2 analysis, I ran a frequency distribution to determine if the errors were normally distributed. A histogram was plotted and it was found that the distribution of the data displayed a skewness of 1.364 and a kurtosis of 1.051. The histogram plot of the Level 2 residuals is seen in Figure A6. From Figure A6 we can see that the distribution of the residuals is skewed right. Therefore, the assumption of normally distributed error has not been met.

The next assumption that must be addressed is that each value of the dependent variable is independent and comes from a separate data entry. Within this data set, all individual values of the dependent variable are independent and belong to a single data entry.

The last assumption that must be examined is the assumption of linearity. This assumption examines whether or not the model being tested is linear or non-linear. In order for a model to be linear each predicted value for each independent variable must lie along a straight line. Therefore, it becomes necessary to graph a P–P plot of the regression of the standardized residuals. This plot is seen in Figure A7. As seen, the line curves downward, which is indicative of data being skewed right. Therefore, the linearity of Model 2.1 is suspect.

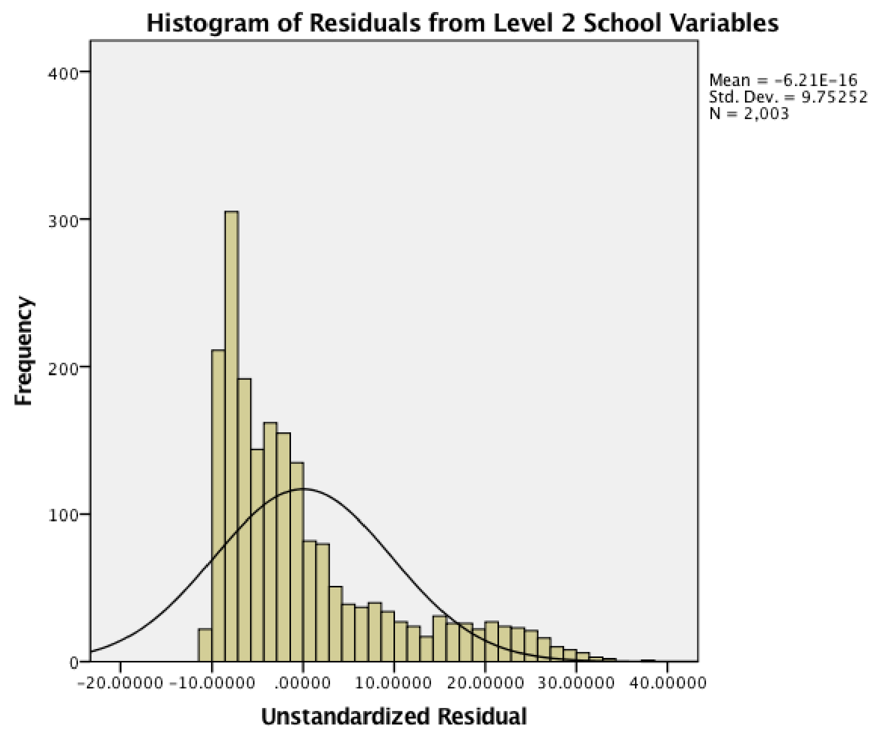



*Figure A6.* Histogram of unstandardized residuals from Level 2 analysis.

Note. Data displayed is skewed right having a large skewness and kurtosis.

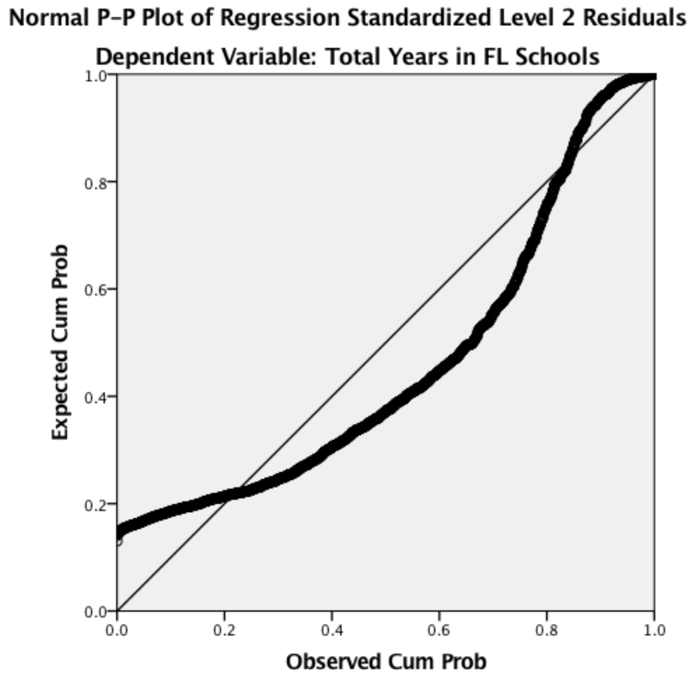



*Figure A7.* P–P plot of regression of standardized Level 2 residuals.

Note. Model 2.1 does not appear linear since the variation in the line is due to a non-normal distribution of the dependent variable.

APPENDIX F – Level 3 Detailed Results and Tests of Assumptions

Model 3.1: Level 3 MLR (All Variables)

*Model 3.1 Tests of Assumptions*

Eight assumptions were checked in order to determine whether Model 3.1 produces biased results. First, all variables, both dependent and independent, are either continuous or categorical variables. A district's average SES and average spending per student are quantitative continuous variables. Second, all predictors have variation (non-zero variance). This is exhibited by the fact that SPSS did not return any warnings in its output. Third, there was no multicollinearity ($r > .80$) between either the independent variables or the dependent variable. The highest correlation exhibited in Model 3.1 is $r = .308$, which existed between the two independent variables.

Next, the assumption of homoscedasticity was examined. Homoscedasticity is visually examined by plotting the regression's standardized residuals versus the standardized predicted values. The plot of these values is seen in Figure A8. In order to have homoscedasticity, the data values should be evenly spread around the zero-mark of both axes. However, Figure A8 clearly has most of the data along a downward sloping line. This means that the data displays heteroscedasticity or is not normally distributed. Further exploration of the data revealed that the independent variables are normally distributed. However, the dependent variable is not normally distributed. In fact, the data is heavily skewed right. This can be seen previously in Appendix D, Figure A2.

The next assumption tested was the assumption of independent errors. In order to determine if the assumption of independent errors is met, it is necessary to perform a Durbin-Watson test, which examines correlations between residuals. The value returned from the Durbin-Watson test of the Level 3 multiple linear regression was 1.938. Since the Durbin-Watson value is close to 2.00, the assumption of independent errors was met.

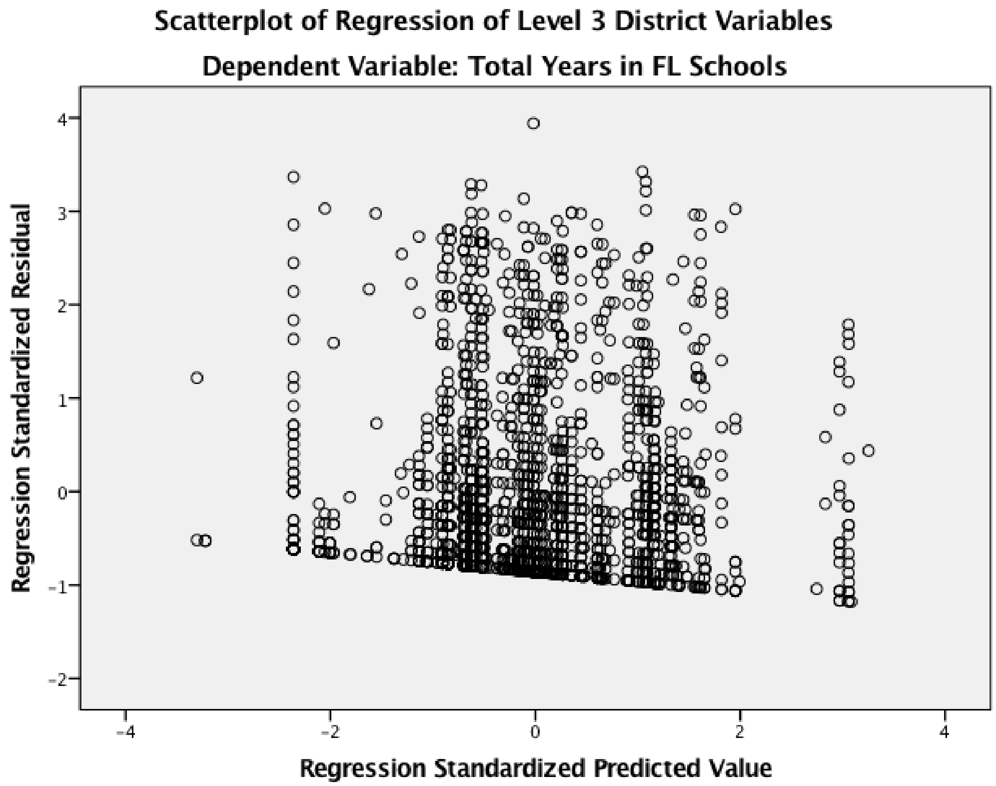



*Figure A8.* Scatterplot of regression of Level 3 school variables.

Note. The data displays heteroscedasticity due to the presence of a non-normally distributed dependent variable.

The next assumption to test was that the model has normally distributed errors. After saving the residuals from the Level 3 analysis, I ran a frequency distribution to determine if the errors were normally distributed. A histogram was plotted and it revealed that the distribution of the data displayed a skewness of 1.398 and a kurtosis of 1.105. The histogram plot of the Level 3 residuals is seen in Figure A9. From Figure A9 we can see that the distribution of the residuals is skewed right. Therefore, the assumption of normally distributed error was not met. The next assumption to be addressed was that each value of the dependent variable is independent and comes from a separate data entry. Within this data set, all individual values of the dependent variable are independent and belong to a single data entry.

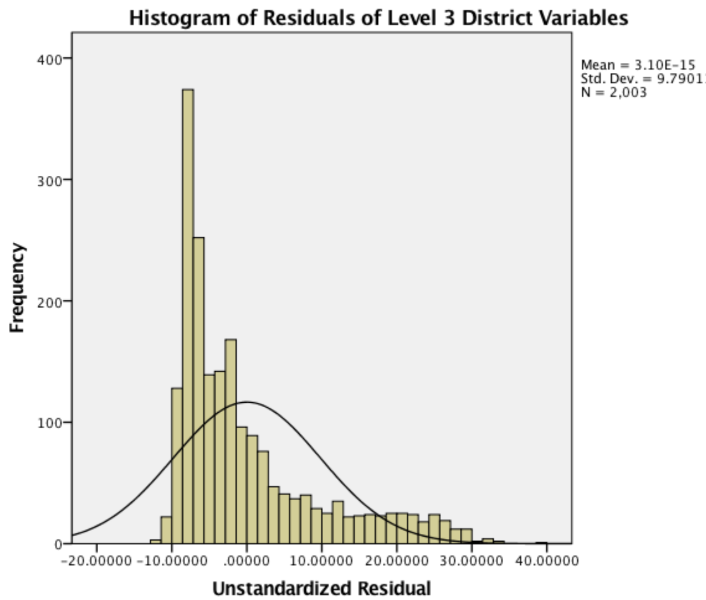



*Figure A9.* Histogram of unstandardized Level 3 residuals.

Note. Data displayed is skewed right having a large skewness and kurtosis.

The last assumption to be examined was the assumption of linearity. This assumption examines whether the model being tested is linear or non-linear. In order for a model to be linear, each predicted value for each independent variable must lie along a straight line. In order to see if Model 3.1 is linear, it is necessary to graph a P–P plot of the regression of the standardized residuals. This plot is seen in Figure A10. As seen, the line curves downward, which is indicative of data being skewed right, as we see in Figure A10. Therefore, the linearity of this data is suspect, but it may be explained by the fact that the dependent variable is heavily skewed right as well.

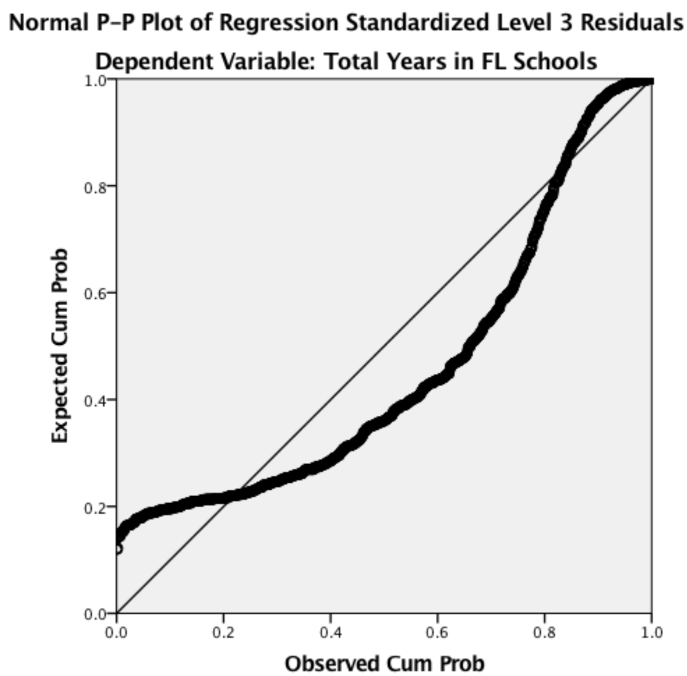



*Figure A10.* P–P plot of regression of standardized Level 3 residuals.

Note. Model 3.1 does not appear linear since the variation in the line is due to a non-normal distribution of the dependent variable.

## APPENDIX G –Detailed HMR Results and Tests of Assumptions

### Model 4.1: HMR (All Previously Significant Variables)

*Model 4.1 Variable Coding*

When coding these variables, a teacher's age is measured in years and their salary is measured in U.S. dollars. A teacher's degree uses the following "dummy" coding scheme: Baccalaureate vs. Unknown is coded as 0 = all other degrees, 1 = Unknown; Baccalaureate vs. Associate was coded as 0 = all other degrees, 1 = Associate; and Baccalaureate vs. Doctorate was coded as 0 = all other degrees, 1 = Doctorate. Regarding the ethnicity of a teacher, the following "dummy" coding scheme was employed: White vs. Asian was coded as 0 = all other ethnicities, 1 = Asian; White vs. Black is coded as 0 = all other ethnicities, 1 = Black; White vs. Hispanic is coded as 0 = all other ethnicities, 1 = Hispanic; and White vs. Native Hawaiian/Pacific Islander was coded as 0 = all other ethnicities, 1 = Native Hawaiian/Pacific Islander.

To code the school's variables, a school's charter status was coded as 0 = public, 1 = charter. A school's SES was measured as a percentage of free/reduced lunches served to that school's 9–12 graders. A school's geographic located used the following "dummy" coding scheme: Suburb vs. City is coded as 0 = all other geographic locations, 1 = City and Suburb vs. Rural were coded as 0 = all other geographic locations, 1 = Rural. A district's average SES was measured as a percentage of free/reduced lunches served to a district's 9–12 graders.

*Model 4.1 Tests of Assumptions*

Eight assumptions were checked in order to determine whether Model 4.1 produces biased results. First, all variables, both dependent and independent, are either continuous or categorical variables. Professional longevity, age, salary, school SES, and district average SES are quantitative continuous variables. A teacher's degree (unknown, associate, and doctorate) and ethnicity (Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander); and a school's charter status, and geographic location (city and rural) are categorical variables as mentioned in the "dummy" coding scheme in the preceding paragraphs. Second, all predictors have variation (non-zero variance). This was exhibited by the fact that SPSS did not return any warnings in its output. Third, there was no multicollinearity ($r > .80$) between any independent variables. The highest correlation exhibited ($r = .500$) in Model 4.1 exists between the independent variables school SES and district average SES.

Next, the assumption of homoscedasticity was examined. Homoscedasticity was visually examined by plotting the regression's standardized residuals versus the standardized predicted values. The plot of these values is seen in Figure A11. In order to have homoscedasticity, the data values should be evenly spread around the zero-mark of both axes. However, Figure A11 is clearly shaped in a sideways "V." This means that the data displays heteroscedasticity or is not normally distributed. Further exploration of the data reveals that most of the independent variables are normally distributed. However, regarding the dependent variable, it was found to not be normally distributed. In fact, the data is heavily skewed right. This can be seen previously in Appendix D, Figure A2.

The next assumption tested was that of independent errors. In order to determine if the assumption of independent errors is met, it is necessary to perform a Durbin-Watson test, which examines correlations between residuals. The value returned from the Durbin-Watson test of the HMR is 1.991. Since the Durbin-Watson value is close to 2.00, the assumption of independent errors is met. The model summary of the multiple regression is found in Table A11.

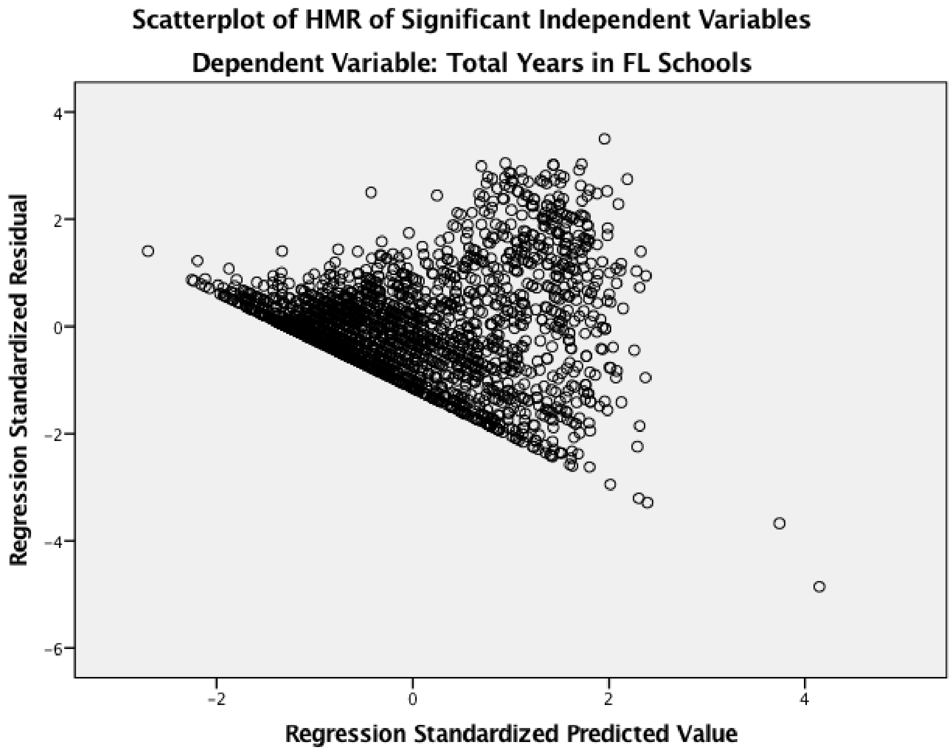



*Figure A11.* Scatterplot of HMR of standardized residuals and predicted values.

Note. Data displays presence of heteroscedasticity due to the non-normal distribution of the dependent variable.

The next assumption needing testing was that the model has normally distributed errors. After saving the residuals from the HMR analysis, I ran a frequency distribution to determine if the errors were normally distributed. A histogram was plotted and it was determined that the distribution of the data displayed a skewness of 0.244 and a kurtosis of 0.907. The histogram plot of the residuals is seen in Figure A12. From Figure A12 we can see that the distribution of the residuals is nearly normal, having a small skewness and kurtosis. Therefore, the assumption of normally distributed error was met.

Table A11.

*Model Summary of HMR Significant Variables*

| Model[a] | $R$ | $R^2$ | *SEE* | $F$ | $df_1$ | $df_2$ | *Sig.* | *Durbin-Watson* |
|---|---|---|---|---|---|---|---|---|
| 1 | .659[b] | .434 | 7.419 | 169.995 | 9 | 1993 | <.001 | |
| 2 | .664[c] | .441 | 7.383 | 5.868 | 4 | 1989 | <.001 | |
| 3 | .668[d] | .446 | 7.349 | 19.934 | 1 | 1988 | <.001 | 1.991 |

[a]Dependent Variable: Professional Longevity (total years in Florida schools). [b]Predictors: Age, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Associate, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. Native Hawaiian/Pacific Islander. [c]Predictors: Age, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Associate, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. Native Hawaiian/Pacific Islander, Charter Status, School SES, Suburb vs. City, Suburb vs. Rural. [d]Predictors: Age, Salary, Baccalaureate vs. Unknown, Baccalaureate vs. Associate, Baccalaureate vs. Doctorate, White vs. Asian, White vs. Black, White vs. Hispanic, White vs. Native Hawaiian/Pacific Islander, Charter Status, School SES, Suburb vs. City, Suburb vs. Rural, District SES.

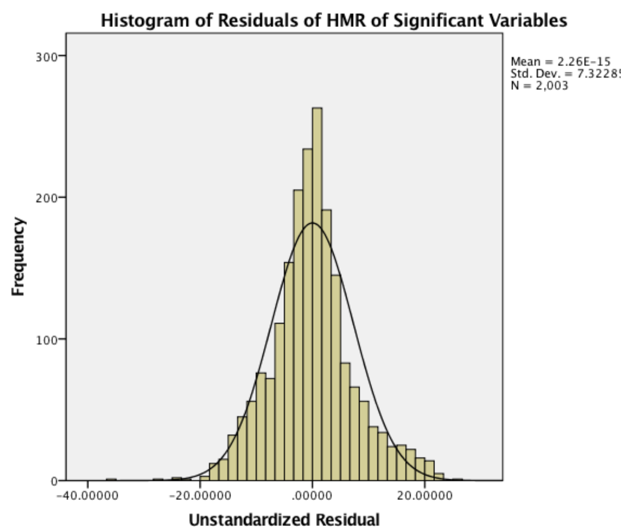



*Figure A12.* Histogram of unstandardized HMR residuals.

Note. Data displayed is nearly normal having a small skewness and kurtosis.

The next assumption addressed was that each value of the dependent variable is independent and comes from a separate data entry. Within this data set, all individual values of the dependent variable are independent and belong to a single data entry.

The last assumption examined was the assumption of linearity. This assumption examines whether the model being tested is linear or not. In order for a model to be linear each predicted value for each independent variable must lie along a straight line. Therefore, it was necessary to graph a P–P plot of the regression of the standardized residuals. This plot is seen in Figure A13. Although the line is not completely straight, it was determined that the variation in the line is due to the non-normality of the dependent variable. Since this is the cause of the variation in the line, the model is essentially linear.

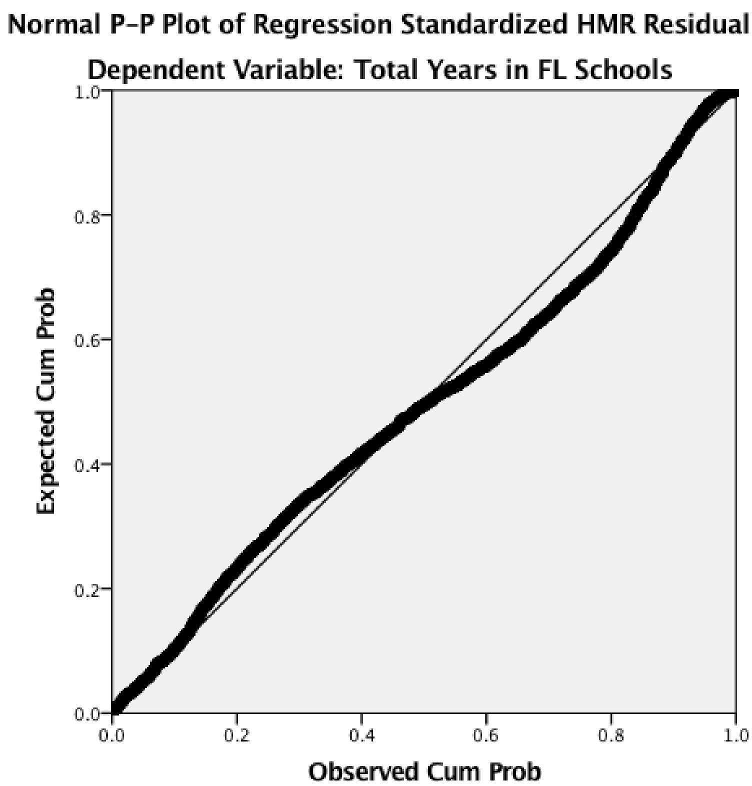



*Figure A13.* P–P plot of regression of standardized HMR residuals.

Note. Model 4.1 is nearly linear since the variation in the line is due to a non-normal distribution of the dependent variable.

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